HELSINGIN KAUPPAKORKEAKOULU
Logistiikka

THE POSSIBILITIES OF POSTPONED MANUFACTURING

Case Product Labeling in Paint Industry – Tikkurila Oy

Pro gradu -tutkielma
Heikki Mikola
30.4.2008

Hyväksytty liiketoiminnan teknologian laitoksella 12.5.2008 arvosanalla
Hyvä, TOP.

Anu Bask

Aimo Inkiläinen

Helsinki School of Economics
Department of Business Technology / Logistics
Master's Thesis
Heikki Mikola

30.4.2008

THE POSSIBILITIES OF POSTPONED MANUFACTURING
Case Product Labeling in Paint Industry - Tikkurila Oy

ABSTRACT

Postponement is an organizational concept whereby some of the activities in the supply chain are not performed until customer orders are received. Companies can then finalize the output in accordance with customer preferences and even customize their products. The concept thus has relations with logistics, manufacturing, and marketing. The recent OM and SC literature has also well documented that the need for postponement is driven by today's market and business environment. However, its applications are still not as widespread as expected. Therefore, we are interested in what factors enable or hinder the successful implementation of postponement. In this study, postponed manufacturing will be considered within the context of internationalization strategies, which in themselves may increasingly require the application of postponement in supply chains. Moreover, our objective is to better understand the challenges that exist in implementing postponement strategies and changing the structure of distribution to fit them.

After a literature review on postponement, we propose an integrated framework that will help to build up a set of general ideas on which further work and practical progress can be based. Despite the focus on paint business, the framework can be used in the analysis of other business fields as well. Driven by the need for customization and rapid delivery to ever more demanding markets in Europe, companies are forced to perform certain final manufacturing activities close to the customer, and often find the flexibility of their own operational model to be insufficient. This is also the situation in the case company, Tikkurila Oy.

Continuously growing export trade and new opening market areas have constantly brought up new challenges concerning product labeling and the instructions delivered with the products. The existing procedures and operations have been found insufficient for the needs of rapidly growing international trade. This is why the main motivation for this study is to find alternative solutions to the problems faced due to the problematical labeling of exported paint products. Before presenting our recommendations, we discuss benefits attainable through each alternative scenario and also list the main challenges regarding their implementation. The results indicate that by decreasing the amount of SKU's and increasing inventory turnover "flexible labeling" enables a more efficient distribution process. Based on previous research and these results, postponed labeling presents itself as a logical choice for the paint manufacturer further expanding its international operations. It could also be seen as the next step towards a more customer-oriented organization.

Keywords: *postponement; mass customization; international distribution; packaging; labeling; paint industry; paint business*

Total number of pages (including appendices): 126

Helsingin kauppakorkeakoulu
Liiketoiminnan teknologian laitos / Logistiikka
Pro gradu -tutkielma
Heikki Mikola

30.4.2008

VAIHEISTETUN TUOTANNON MAHDOLLISUUDET
Tuotemerkinnät ja etiketöinti maaliteollisuudessa – Case Tikkurila Oy

TIIVISTELMÄ (ABSTRACT IN FINNISH)

Vaiheistettu tuotanto on mielenkiintoinen käsite, jossa osa toimitusketjun toiminnoista ja tuotannon vaiheista toteutetaan vasta jakeluketjun varrella, lähempänä markkinoita ja loppuasiakasta. Yritykset voivat viimeistellä tuotteitaan vastaamaan yhä paremmin loppuasiakkaan tarpeita ja toiveita, ja mahdollisuuksien mukaan kustomoida tuotteitaan eri markkinoille. Käsite linkittyykin läheisesti niin logistiikan, tuotannon, kuin markkinoinninkin tutkimukseen ja käytäntöihin. Useita käsitteen käytännön sovelluksia on viime vuosikymmenien aikana ollut esillä julkisuudessa sekä OM että SC kirjallisuudessa. Useimmat näistä viivästyttämisstrategioista ovat kuitenkin olleet elintarvike- ja elektroniikkateollisuudesta, eikä käsite muutoin ole laajemmin levinnyt yritysten arkeen. Siksi olemmekin erityisen kiinnostuneita tekijöistä, jotka estävät tai mahdollistavat tuotannon vaiheistamisen. Tämä tutkimus linkittää vaiheistetun tuotannon mahdollisuudet kansainvälistymisstrategioihin, jotka osaltaan usein vaativat tuotannon jonkinasteista vaiheistamista ja uusia toimintatapoja. Tavoitteena oli lisäksi ymmärtää yhä paremmin vaiheistetun tuotannon käytännön sovelluksiin sekä jakelun rakenteellisiin muutosprosesseihin liittyviä haasteita.

Aiheeseen paneutuvan tutkimukseen perehtymisen jälkeen esitämme vaiheistetun tuotannon perustaville ajatuksille rakennetun viitekehyksen, jota yritysten viivästytettyyn etiketöintiin liittyvä kehitystyö ja toimintamallien muutos voi seurata. Kehittyvät markkinat Euroopassa vaativat kansainvälistyviltä yrityksiltä yhä korkeampaa palvelutasoa ja räätälöityjä tuotteita kasvaviin tarpeisiinsa. Kohdatessaan nämä uudet haasteet toteavat yritykset usein oman toimintamallinsa joustavuuden riittämättömäksi. Tämä on vallitseva tilanne myös tutkimukseni case-yrityksessä, Tikkurila Oy:ssä.

Kasvava vienti sekä uudet avautuvat markkina-alueet ovat tuoneet maalivalmistajalle jatkuvasti uusia haasteita tuotteiden etikettien ja käyttöohjeiden osalta. Niissä tarvittavien kielivariaatioiden kasvu asettaa omat lisähaasteensa yrityksen ja koko konsernin käytössä oleville prosesseille. Kiinnostuksen kohteena tutkimuksessa onkin erityisesti vaihtoehtoisten ratkaisujen löytäminen vientituotteiden etikettejä koskeviin ongelmiin, ja mahdollisuus viedä tiettyjä eri tavoin tuotteita varioivia tuotannon viimeisiä vaiheita lähemmäksi markkinoita ja loppuasiakasta. Ennen kuin esitämme omat toimintasuosituksemme, käymme läpi näiden vaihtoehtojen avulla saavutettavat edut, ja listaamme kunkin toimintamallin keskeisimmät haasteet ja implementoinnin ongelmat. Tutkimuksen tulokset osoittavat, että "joustava etiketöinti" vähentää varastoitavia tuotenimikkeitä, lisää varaston kiertoa, ja mahdollistaa entistä tehokkaamman toimitusprosessin. Tutkimustulosten perusteella vaikuttaa siltä, että vaiheistettu etiketöinti on looginen vaihtoehto kansainvälistyvälle maalivalmistajalle, ja samalla yksi askel kohti asiakaslähtöistä organisaatiota.

Avainsanat: *vaiheistettu tuotanto; massaräätälöinti; kansainvälinen jakelu; etiketöinti; viivästyttäminen; maaliliiketoiminta; maaliala*
Sivujen lukumäärä (liitteineen): 126

ACKNOWLEDGEMENTS

Without Raimo Laamanen, of course there would have been no thesis. When I started thinking about applying for this project, he and his colleagues at Tikkurila group had already been thinking about their labeling process and the possibilities and feasible solutions to help the company to face the challenges of internationalization. Raimo and Paula Aaltonen as overseers of the research work have also both been supportive and understanding throughout the entire research process.

I wish to thank Doctor Aimo Inkiläinen for his guidance and support over the last year, starting when I first was conducting a business project under his supervision. Since then several fellow students have commented that I should be very happy to have such a supervisor. His research background considered, I have been especially fortunate having been able to receive his support and comments.

I am also grateful to Prof. Anu Bask for her guidance and tips along the way. As the chief supervisor of this thesis she gave her advice on how to proceed with e.g. the structure and visualization of the study. It really helped to have her academic standpoint to the study and hear how certain things should be presented and included in the thesis.

I wish to thank also the tens of managers and workers of Tikkurila group who have been willing to work with me on the case study, and provide me with data, their experiences and suggestions related with the concept of "flexible labeling". Also I would like to thank the people at Nokia and Orion who made the interviews possible and were willing to share their experiences about postponement applications and other practical issues related with product labeling.

Finally, I want to thank my family and friends for their patience and support during the whole thesis process. Thank you for your understanding.

Helsinki, April 2008

Heikki Mikola

THE POSSIBILITIES OF POSTPONED MANUFACTURING
Case Product Labeling in Paint Industry - Tikkurila Oy

Table of Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. Introduction

In recent years, increased product variety and service requirements with increased competition have led manufacturers to find new product and process redesigns. Postponed manufacturing has been coming to the forefront as an innovative supply chain arrangement in a multitude of industries, including the chemical industry. The increasing variety arousing from regional differences between markets has put many great international companies in a situation where the growing product range is becoming impossible to manage and control. The manufacturers of consumer goods now seek for new ways to fight the ever-increasing variation surrounding their product assortments. For this cause the research has suggested many alternative methods and processes the manufacturers can apply, out of which this study focuses on labeling postponement.

Traditional practice has focused on achieving economy of scale by planning long manufacturing runs. In contrast, flexible and lean manufacturing logic is driven by a desire to increase responsiveness to customer requirements. To support this, in most cases today, the development is towards mixed supply chain structures, where manufacturing takes place at many points along the distribution channel. Also the role logistics plays in effective competition is widely recognized as enabling superior customer service performance. Fine-tuned logistical processes, as postponed labeling, serve to synchronize product delivery with market demand. The goal is to increase the responsiveness of the whole distribution system and in this way give customers what they want, when they want, and at the lowest possible cost. This development has motivated companies to shift parts of their manufacturing activities either upstream from national operations or downstream from global production plants and tune their logistics systems to the extreme (Harrison & Van Hoek, 2005). Postponement alone still doesn't ease the abovementioned pressure caused by the ever-increasing product variety and the lack of responsiveness in the supply chain. The limited resources of the downstream members of the distribution channel would then have to be divided between various functions, because of the units' compulsion to serve both external and internal customers, i.e. company's other operations. In this respect we also need to consider what factors influence the viability of postponed manufacturing in the paint industry, and take a closer look into the steps of the production process where postponement could add value by providing increased flexibility.

What is in a significant role when developing manufacturing processes and executing new process redesigns, is the question of when and how the employment of postponement can be especially beneficial? And what are the concrete benefits actually achievable through postponement? This consideration is closely related with the question of each channel members' responsibilities and role in the organization's distribution channel.

1.1. Research Problem and Motivation

The global competitive climate of the 21st century is facilitating the development of new manufacturing techniques designed to increase the flexibility and responsiveness while maintaining unit cost and quality. The research problem of this study concerns the possibilities of form postponement in the international distribution channel; how to assess, evaluate and justify in a managerial way the best-fit configuration for a firm's already extensive distribution system. This calls for analyzing the possible applications of postponement strategies and structural characteristics of the distribution system and finding ways to measure the actual performance of the distribution channel as a whole.

The case company Tikkurila Oy is an international organization currently expanding their current distribution system and investing in the structure of their logistics network. In the middle of all this also structural changes within the network are considered and thus all fresh ideas considering the future practices were welcomed. In short, motivation and grounds for this thesis all come down to the questions:

- What kind of frameworks does the existing literature offer for responsive operational models?
- How could we add more flexibility into the labeling process of the paint products?
- What are the possibilities that postponed manufacturing presents for Tikkurila's operations and processes?

The company's new facilities deployed abroad are in no way said to be restricted to only warehousing and the investments call for a more comprehensive analysis of the possibilities regarding postponed manufacturing functions like additional labeling and packaging lines. The company has set ambitious goals for international growth and is now looking for the best ways to utilize its soon-to-be logistics centers abroad. All this motivated to discuss the possibilities of

postponed manufacturing in the context of different product labeling solutions and internationalization of paint business. And when only relatively little research on the possibilities of postponed manufacturing and its practical applications could be found, motivation for the work was there.

In summary, this study's purpose is to seek ways to increase flexibility and enhance the responsiveness of the whole supply chain by looking into the possibilities to apply different postponement strategies, along with the appropriate distribution structures. In contrast to most of the previous discussions in Finland, which have concentrated on paint production and tinting solutions, this study discusses solutions related with peripherals of paint products at international level. Moreover, there is still little research related to postponement that addresses the crucial issue of interorganizational relationships in the distribution channel.

1.2. Objectives of the Study

This research attempts to provide some tools to understand the different ways to increase the *flexibility* of supply chains. The thesis focuses on the manufacturing-distribution end of the SC in international paint industry and excludes the area of procurement and purchasing. Realizing that the research problem is very complex, we will aim at rather finding and justifying the best-fit or near-optimal solution than the optimal solution. First, the objective is to answer the first research question: Are there holistic, conceptual and process-based frameworks for labeling postponement that are applicable in practice? And if such are identified, can they be useful in the quest for a flexible solution to organizational product labeling dilemma. We also seek for the right theoretical pieces to include in our integrated framework for postponed labeling applications, and highlight the practical and theoretical issues we believe to be essential.

The second objective is to find answers to the second and third research questions: How should Tikkurila Oy start to develop its distribution network and supply chain structure to support the possible implementation of "flexible labeling"? How would the new distribution network look like and where and what kind of role could postponement play there? The purpose is to suggest some trends in the industries battling with similar difficulties and to lay down a proposition on how to proceed with the next 2-3 years action plan. In other words, we seek answers to the questions, where, how, why and by whom should product labeling take place, and what are the resources that will enable this?

Finally, the last objective is to answer the fourth research question: What are the relevant costs and benefits achievable through the use of postponement that Tikkurila should take into account when finding solutions to support its international expansion? We will discuss the related performance factors in detail, and then evaluate the alternative scenarios with them in mind. We will also have a closer look at the cost structure of international distribution and of course, product labeling. The focus here will be on the structural changes and required investments that will subsequently follow the implementation of labeling postponement. Also the resulting future scenarios are further examined (pros and cons) and compared cost-wise between each other.

In a nutshell, the aim of this study is to explore the possibilities of postponed labeling applications empirically, present a integrated framework applicable within similar industries, and set up a strategy proposition for the managers at Tikkurila that would support the escalating growth of the company's international business. Additionally, we will make an effort to find different practical solutions to the problems related with product labeling, and see how well they fit the operative environment of an international paint manufacturer.

1.3. Limitations of the Study

As this research defines product labeling as means of marking the visible layout of products with text, figures and pictograms perceptible for human eyes, other product marking technologies, such as RFID applications, invisible bar codes, laser engraving or sand carving, are excluded. This is justified by the characteristics of the products in question and the established practices of the paint industry.

Furthermore, the impact of manufacturing postponement on competitiveness is explored concentrating on *labeling postponement*. This research is not limited to finding linkages between the application of postponement and competitiveness only in the sector of international paint business, but theoretically includes all manufacturing sectors dealing with product labeling. Also, manufacturing and marketing of both *consumer* and *industrial* products are included in the research. However, only internationalized or strongly internationalizing companies fall into the range of interest within these manufacturing sectors when building the framework.

The heightened interest to applications of postponed manufacturing is closely related to the formation of internationalization strategies. And although the concept of postponed labeling is not new, its application is still in its infancy, which resulted in the fact that during the research only limited amount of exemplary applications could be found. This of course restricted the comprehensiveness of the observations made, but at the same time is what made it especially interesting to pursue in this study, and the somewhat never-ending quest for answers.

1.4. Research Methodology

This research includes a case study conducted in Tikkurila Oy, Vantaa – Finland. The method employed in the empirical part of this thesis is qualitative analysis, a case study method. Between September 2007 and April 2008 numerous interviews were conducted in Tikkurila Paints Oy and Tikkurila Coatings Oy respectively. During this time the author attended several meetings and discussions related to paint product labeling and the challenges faced on the export markets. To gain additional perspective on the actual flow of goods and the existing operating structure, direct observation of the operations and practices was also used. Next we will discuss in more detail the research strategy of qualitative research, the role of this research strategy in logistics and supply chain management research, how the case study method can be used, and finally why we chose this method for the research in question.

According to Bask (2006) there has been growing interest in research approaches that allow qualitative analysis and the use of the case study method in business research. During the 1990's qualitative techniques did not receive widespread use and acceptance in logistics and SCM research, but something has significantly changed their position and value. This can be easily seen from a review done by Sachan and Datta (2005). They examined logistics and SCM research from 1999 to 2003 from the point of view of existing methodologies. This review included 442 articles published in three widely respected logistics journals: the Journal of Business Logistics (JBL), International Journal of Physical Distribution & Logistics Management (IJPDLM) and Supply Chain Management: An International Journal (SCMIJ). Although the survey method is still dominant in logistics research, their results shows that there is a notable increase in direct observation methods like case studies (see Table 1).

TABLE 1. Research methods in logistics and supply chain management research (Sachan & Datta 2005)

Research Methods	JBL (%)	SCMIJ (%)	IJPDLM (%)	Total (%)	Mentzer & Kahn (1995) (%)
Survey	52.2	22.4	35.5	**34.6**	54.3
Simulation	9.8	2.0	4.9	**5.0**	14.9
Interviews	3.3	10.2	5.9	**6.8**	13.8
Math Models	13.0	5.4	12.8	**10.4**	4.3
Case Study	4.3	25.2	14.8	**16.1**	3.2
Conceptual Models	4.3	7.5	6.4	**6.3**	-
Others	13.0	27.2	19.7	**20.8**	9.6

In their acknowledged article Sachan and Datta present a comparison of their results and the results of Mentzer and Kahn in 1995. Both results indicate that survey is a common method used in logistics research. Survey is highest in *JBL* and *IJPDLM* and holds second rank in *SCMIJ*. At the same time the most significant decline can be seen in the use of survey, simulation and interviews as research methods. But what is most noticeable in the findings of Sachan and Datta is the new status of case study method, and how remarkably its use has increased. Bask also cites other studies that support these findings by pointing out that case study research and SCM have only recently become popular.

In this thesis we used a single case study, the labeling processes of Tikkurila's internationally marketed paint products. For additional perspective and experiences of different models for product differentiation structured interviews were also conducted with companies operating in other industries and different environments. There were several reasons why we chose the case analysis and this one case, starting from the triggering initiative from company representatives. In general, following Ellram's recommendation (1996, 115) to use case study research methodology when exploring implementation issues and options in the adoption of expert systems in logistics, the study was based on qualitative analysis, concerned the cost sector and had a micro approach.

Ellram (1996) illustrates how the case study method can be used in business research focusing on particular purchasing and logistics research. Qualitative methods are preferred if the goal is to explain or to understand a phenomenon, i.e. the aim is to develop our understanding of real-world events (Sachan & Datta 2005). The main purpose of the empirical study is to analyze the labeling processes and potential of different postponement strategies to be utilized by Tikkurila. To probe the how and why questions, Ellram (1996) suggests qualitative methods that provide a depth and richness to be used in the research. Also, the case study method is useful in the early phases of research (description, concept development) where there may be only very little previous work to support the research (Sachan & Datta 2005). Thus, for the situation with Tikkurila, just starting to conceptualize its "flexible labeling" when this research on the topic began, the case study method is a relevant method. Typically, case studies combine data collection methods from primary and secondary sources such as archives, interviews, questionnaires, and observations (Bask, 2006). This thesis utilizes most of these methods.

1.5. Structure of the Study

The structure of the study is schematically depicted in Figure 1-1. The thesis is divided into six chapters, and proceeds from literature review to the creation of our framework, and its application to the case company. Most of the contents of Chapters 1 and 2 is based on former studies and existing logistics literature, while Chapters 3 to 6 form the basic contribution of this research. The introductory chapter gives the motivation and the objectives of the study. The next two chapters expand on the theoretical basis of this study. Chapter 2 summarizes the existing literature on postponement to extend the concept of form postponement and describes its use in interorganizational contexts. It also distinguishes the nature of labeling postponement as a mode of postponed manufacturing and also considers labeling postponement as a possible strategy – structure fit. In the third chapter we assess on the importance of the structure of activities/processes within and between companies, and present our framework for analyzing flexible manufacturing applications, especially in postponed labeling.

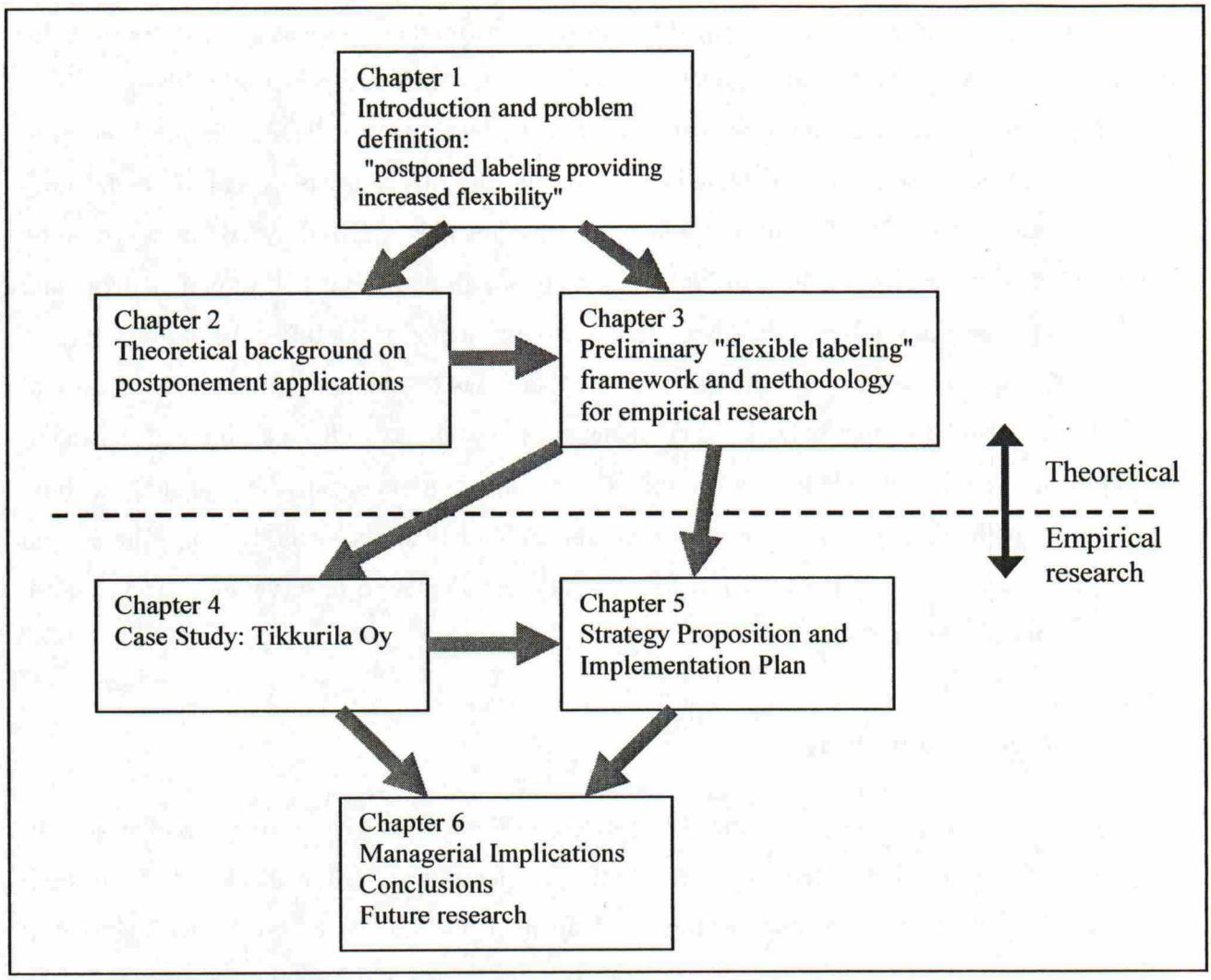


FIGURE 1-1 Structure of the study by chapter

The empirical study was performed in cooperation with the Finnish company Tikkurila Oy, which is responsible for Kemira's paints and coatings business and develops, markets and produces paints and coatings for the general public, professional painters and industrial users. Chapter 4 introduces the case company, and describes the situation and current challenges related with their product-labeling dilemma. Overall, the empirical part of the research is scattered inside both the fourth and the fifth chapter, whereas the fifth chapter describes the implications of this research and summarizes our strategy proposal and implementation plan. With the help of the framework and theories presented in the previous chapters, the study seeks to provide Tikkurila Oy with tools and recommendations on how to further develop their processes in the future. Finally, the last chapter presents future research opportunities and sums up our most important findings and conclusions.

1.6. Terminology and the Definitions

The customer is either an end-user or any intermediary of the distribution system having an operator one echelon above. As an example, an end-user is a customer to a retail dealer, a retail dealer (intermediary) is a customer to wholesaler etc. A consumer is the same as an end-user and these words are used interchangeably throughout this study.

The customer order decoupling point (CODP) is the point in a value-adding process where a customer order penetrates the operating system and where a product is linked to a specific customer order. The position of the CODP along the supply chain varies. Downstream from this point, operations are order-driven; upstream from this point, forecast-driven.

The European Product Range (EPR) is Tikkurila's specially tailored product assortment that consists of decorative paint products specially designed for the European markets, where the company currently seeks growth and market share.

Form postponement is the strategy of delaying product differentiation until as late as it is cost-effective (Garg & Lee 1997, 1).

Mass customization is the capability to produce customized products while achieving the cost benefits of mass production (Cravens 1994, 213).

Point of product differentiation (PPD) is where the actual transformation in terms of form and identity of the product takes place, and common raw materials, parts or sub-components become multiple product derivatives. The term should not be used as a synonym for *customer order decoupling point*, as these are two distinct concepts (Garcia-Dastugue & Lambert 2007).

A *supply chain* (SC) is a network of suppliers, subsuppliers, intermediaries and customers in which any business operates. Supply chain management (SCM) means managing the flow of goods and services and related information from the point of origin to the point of consumption. SCM aims at "the synchronization of all channel activities in a manner which will create the greatest net comparative value for the customer" (Langley and Holcomb 1992).

Time postponement is the delay of forward movement of products; changes in inventory location occur at the latest possible point in time (Zinn & Bowersox 1988).

Variants at the order penetration point figure (VOPP) is the actual number of different products variants at the point which customer order information reaches. This figure is widely used by different companies to help them understand the essence of problems due to product variety.

Value-Added Services typically change the physical features of configuration of products so they are presented to customers in a unique or customized manner. A value-added service is any work that creates a greater value for customers (Bowersox et al. 2007, 219). These services can be either included in the company's own operations or outsourced from a third party service provider.

Later on in the study postponement means in most contexts only form postponement, but also the theory behind time postponement is discussed in the literature review. We also argue that the above definition for form postponement is not faultless and thus prefer the more descriptive definition introduced by Helander A. (1999, 228): *Form postponement* is the strategy of delaying product differentiation as long as possible in the distribution channel provided that it creates additional benefits for each participant.

Also the concept of form postponement is further analyzed in chapter 2. Moreover, definitions for postponement are more thoroughly discussed, including different postponement types and levels.

2. Theoretical Background on Postponement

Since the industrial revolution, the dominant business model has required anticipation of what customers will demand in the future. Because information concerning purchase behavior was not readily available and firms loosely linked together in a channel of distribution did not feel compelled to share their plans, business operations were driven by forecasts. More recently the supply chains have developed away from the traditional anticipatory business model towards responsiveness. Managers are increasingly sharing information to improve both the speed and the accuracy of supply chain logistics. This transformation from anticipatory toward responsive business is possible because today's managers have the technology to rapidly obtain and share accurate sales information and exercise improved operational control. It is also relevant in the sense of our research and the concepts of postponement and speculation.

In academic literature theory of postponement has an extensive history, which dates back to 1950 when Alderson first coined the term postponement and argued that overall costs could be reduced by postponing a differentiating stage of production (Alderson, 1950). Later Bucklin (1965) extended the concept of postponement by viewing it as an opportunity to shift the risk of owning goods from one position in supply chain to another. He argued that some entity in the channel would have to bear the risks associated with product variety, and postponement only helped in shifting this risk. However, as manufacturing firms started to move away from the traditional make-to-stock environment, postponement has become an attractive alternative.

We will first discuss postponement and speculation more thoroughly, and examine the four generic supply chain postponement and speculation strategies. Then we have a look at different types of postponement, before briefly introducing the concepts of time-based competition and mass customization, two market trends that give some background for the later presented framework and further analysis.

2.1. Postponement vs. Speculation

Postponement and speculation are logistical concepts that question where and when to add value (time, place and form utility) in distribution channels in order to reduce cost and risk (Twede et al., 2000). Several researchers (e.g. Zinn & Bowersox 1988; Van Hoek 1997; Lee & Tang 1997;

Brown, Lee et al. 2000) have studied postponement. In Finland, Inkiläinen (1998) discussed the possibilities of postponement as a strategy that helps companies creating cost efficient yet responsive distribution systems, whereas Helander (1999) studied the performance factors of form postponement.

The principle of speculation says that manufacturing, packaging, and shipping should occur at the earliest possible time in the marketing flow in order to achieve economies of scale. Speculation is the basis for traditional logistics model. Because it relies on forecasts that can sometimes prove to be incorrect, speculation has its weaknesses. Postponement conversely, is the opposite of speculation. While the philosophy of speculation relies on doing things today that you can put off until tomorrow, the principle of postponement allows later action based on more timely information. In other words, the principle of time and form postponement reduces risk by requiring that changes in form, identity and inventory location occur at the latest possible point in the marketing flow, since every differentiation that makes a product more suitable for a specified segment of the market makes it less suitable for other segments. Postponement enables a company to keep its options open on how to and where to design, produce, or distribute the product, incorporating the flexibility to cope with environmental uncertainty.

Researchers suggest that postponement has the potential to improve responsiveness while reducing inventory, transportation, storage and obsolescence costs (Boone et al. 2007). And actually, in an ideal world, companies should trigger the entire design-make-ship cycle only when a clear demand signal is available (Yang et al., 2004, 468). If only theoretically possible, this may be classified as the highest level of postponement, which enables companies to maximize their profits through fully understanding real customer requirements. In reality, it is nearly impossible to develop such a postponement strategy in many instances because of the tolerance time (that the customer is willing to wait). Still, many companies (Dell, Hewlett-Packard, Dole, Volvo, Toyota Motor Corporation, clothing manufacturer Benetton, etc.) are exploring ways toward this in response to specific market characteristics and constantly changing demands. Clearly, the potential of postponement to create significant supply chain improvement has not gone unnoticed by practitioners.

2.1.1. Practical applications of postponement

Throughout the last ten years the use of postponement strategies has increased in the practice of international business. Internationalization has resulted in increasing product variety especially among exported consumer goods, while the role of customized service in the competitive environment of manufacturers has ever more emphasized. As a result of these developments, in the international distribution and marketing channel, final processing or manufacturing activities have increasingly been moved either upstream from national operations or downstream from global production plants. Based upon a large-scale survey of companies in Europe (Van Hoek 2000), Figure 2-1 presents average application levels for postponement along given supply chain operations aggregated across various sectors, countries and supply chain positions. According to Harrison and Van Hoek (2005, 280), the overall pattern indicates that the application of postponement decreases when moving further upstream and away from the end customer.

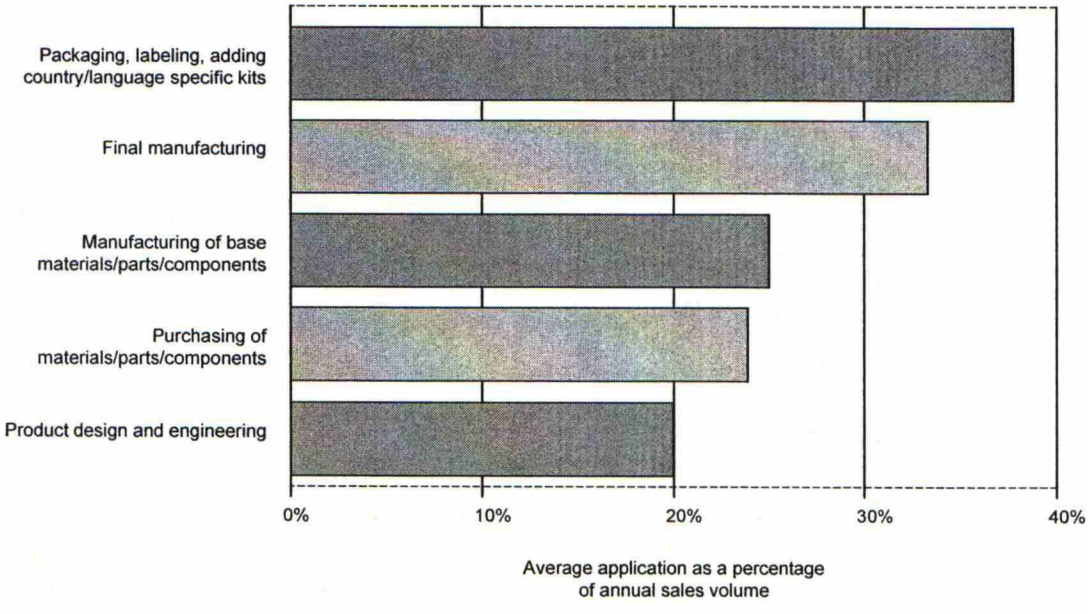


FIGURE 2-1 Postponement applications across supply chain operations (Van Hoek 2000)

Downstream, postponement applications are ahead of those upstream, with over one-third of pre-delivery packaging activities performed according to end-customer specifications and needs. Obviously, these activities do not generate the greatest level of customization but in addition to delivery services (schedules and time-tables, etc.) they can tune the logistics link with the end-customer. The overall pattern, as displayed in Figure 2-1, confirms the cross-functional relevance of postponement, since it is practiced across different functions ranging from engineering through supply, through production to pre-delivery activities. The newly born supply chain structures

often involve time postponement or delaying product differentiation points until customer orders have actually been received. However, postponement is not a viable strategy for all industries, as not all products allow for a base stock of generic components or semi-finished products, which can be later combined into a variety of finished products. In this respect we also need to consider what factors influence the viability of postponed manufacturing in the paint industry, and take a closer look into the steps of the production process where postponement could add value by providing increased flexibility.

According to a study made by the Council of Logistics Management, postponement already in 1995 had a long history of practical business application dating all the way back to the 1920s. Often, referenced examples of postponement include Benetton, Whirlpool, and Hewlett Packard. Benetton used postponement to improve its responsiveness to customer demands. By postponing the dyeing of its garments, the company could better position itself to respond to demands for popular colored clothing and reduce excess inventory of less-popular colors. Whirlpool then again, realized a significant reduction in inventory and transportation costs, when it postponed its shipment of appliances to Sears (a big-box US retailer) until a customer order was received. HP in turn, postponed the final assembly of its DeskJet printers until the very late stages of the supply chain. This "classic" of postponement applications, combined with the shift of assembly locations closer to customers, resulted in a more cost-efficient production process while reducing both transportation and logistics costs (Boone et al. 2007).

2.2. Postponement Strategies

Postponement strategies, or delayed differentiation, were first proposed in the early 1950s (Alderson 1950; Bucklin 1965). Studies in the field have been predominantly material-based (Van Hoek 1997; Brown, Lee et al. 2000) and have been produced under a static environment. Most of these strategies are based on the theory of risk pooling, which occurs when aggregating demands for many finished goods into a demand for fewer dies. Since the aggregate demand is less uncertain, the firm can hold smaller inventories while providing the same level of service (Brown, Lee et al. 2000). Because a pooled system costs less than a distributed system, this structure for distribution has been widely adopted in areas such as insurance, where to reduce risk is the primary concern.

For managerial decision-making, Pagh and Cooper (1998) operationalize the theory of postponement and speculation by determining four generic strategies, namely: the full speculation strategy, the manufacturing postponement strategy, the logistics postponement strategy and the full postponement strategy (Pagh & Cooper 1998) (see Figure 2-2).

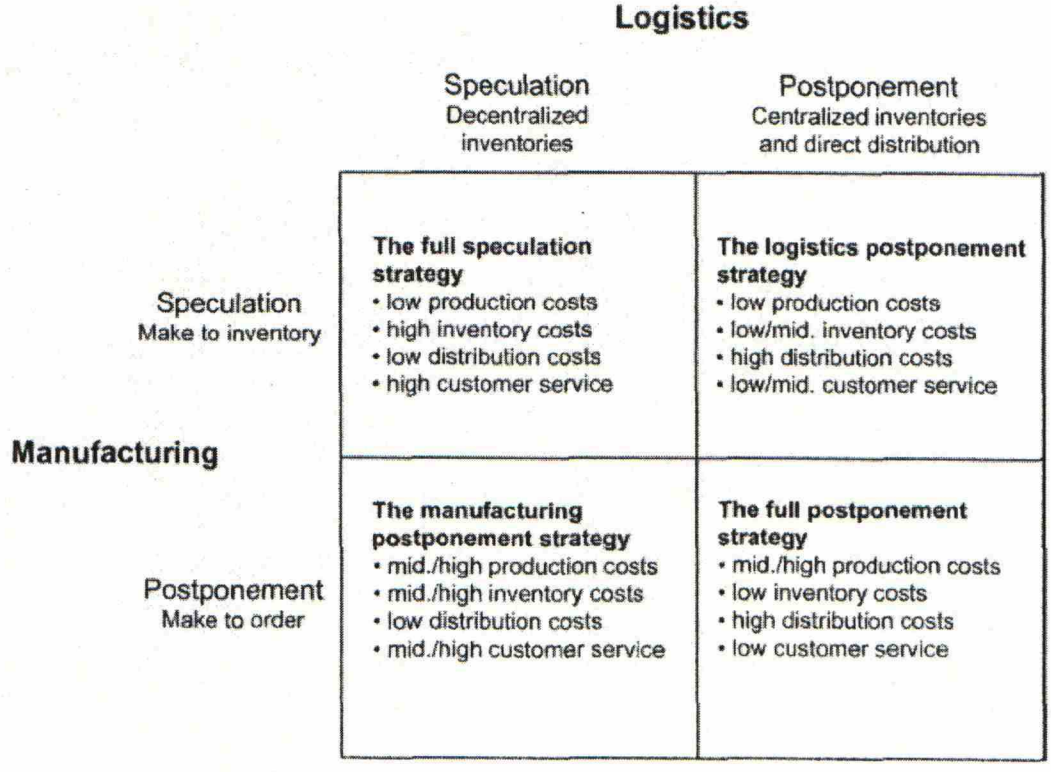


FIGURE 2-2 The P/S-matrix and the generic supply chain postponement and speculation strategies (Bask 2001, 472; adapted from Pagh &Cooper 1998)

The rows of the matrix (see figure above) represent whether manufacturing postponement or speculation is employed, and the columns whether logistics postponement or speculation is employed. The various strategies have several inherent advantages and disadvantages. The discussion on these is primarily based on costs and customer service[1] as evaluation parameters.

Following the article of Pagh and Cooper (1998), in the *full speculation strategy* products are stocked in a decentralized distribution system close to customers. Before the products are distributed to the decentralized distribution system all manufacturing is executed. The consequences of employing the *full speculation strategy* are difficult to generalize, while some of them are rather obvious: Economies of scale are achieved, since large standardized product lot-sizes can be manufactured and distributed together. On the other hand, the inventory investment

[1] Customer service =Product availability and delivery time.

will be high, the highest of all four of the P/S strategies, because of the decentralized inventories. Moreover, obsolete products and transshipments may occur.

Relatively high investments in inventories are the case also with the *manufacturing postponement strategy*, around which this thesis is tightly build up on. This strategy applies to a situation where final manufacturing operations (light manufacturing, final assembly, packaging or labeling) are carried out after the order from the customer is received and after the product has been to some degree logistically differentiated (Pagh & Cooper 1998). The operative goal of this strategy is to maintain products in a neutral or noncommitted status as long as possible, and only perform final manufacturing when customer-specific sales information is received. The ideal application of form postponement is to manufacture a standard or base product in sufficient quantities to realize economies of scale while deferring finalization of features, such as packaging or accessories, until customer commitment is received. As a result of this, manufacturing costs increase slightly, but the total value of inventory is reduced in terms of the number of safety stocks and stock keeping units (SKU's). In comparison to the *full postponement*, also illustrated in the P/S matrix, this strategy, and the daring tactics to perform final manufacturing in a decentralized distribution structure, is especially appropriate in cases where it is vital to have market-specific inventories close to the customer.

2.3. Types of Postponement

In their highly acclaimed article from 1988, Zinn and Bowersox described different types of postponement that could be implemented. These included labeling postponement, packaging postponement, assembly postponement, manufacturing postponement, and time postponement. This perception and categorizing of postponement continues, in part, to this day.

In the Figure 2-3 Yang and Burns (2003) present different supply chain strategies and related postponement applications that can be identified in many industries. We will next briefly discuss each postponement type, and specify the benefits achievable through the successful application in each case. What is noteworthy here is the point along the supply chain where each postponement type usually starts to generate savings. Basically, all the different postponement applications can be simplified and fitted on a continuum starting with pure speculation and ending with pure postponement.

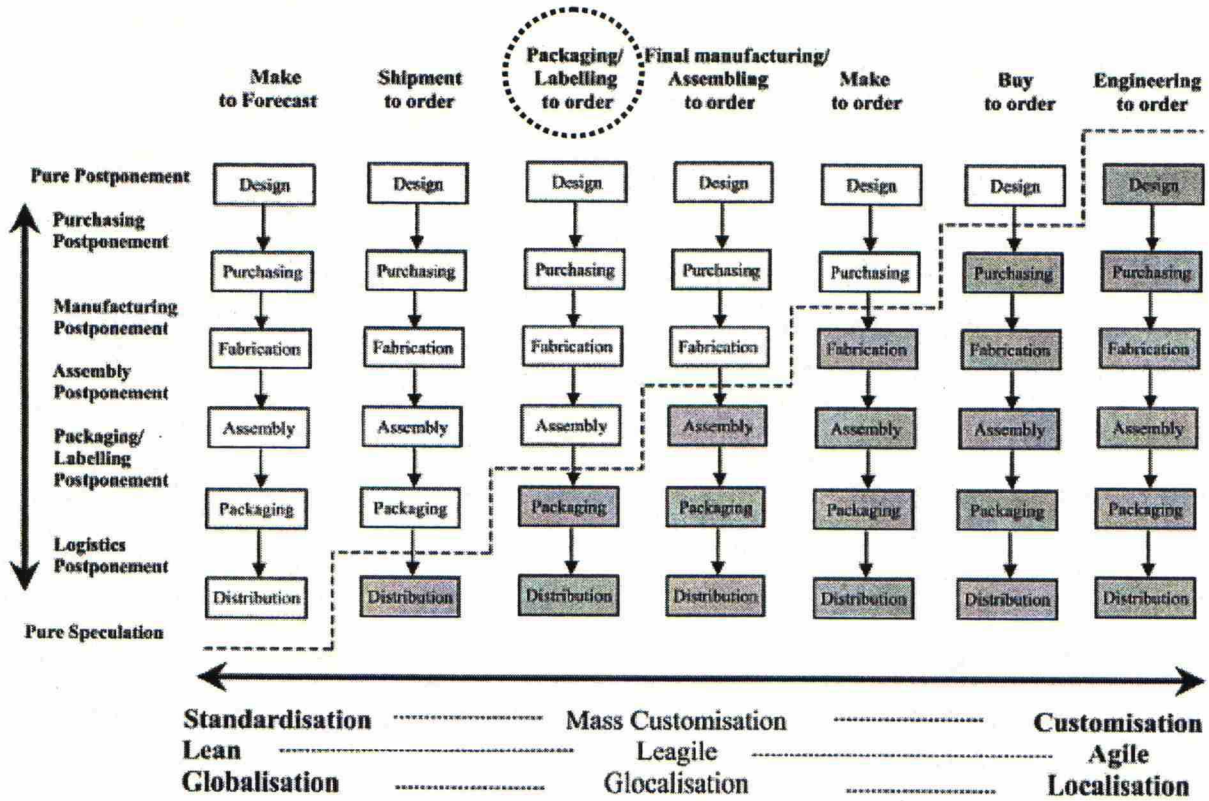


FIGURE 2-3 From pure postponement to pure speculation (Yang and Burns 2003)

The interesting illustration above lets the reader know about a motivating trend in businesses dealing with consumer goods in a global environment. What can be called "*glocalisation*" is when companies strive for success by trying to localize their products on a global level, as late as is practically possible. Our interest and the focus of this study lies particularly on the third level of the whole range and is encircled accordingly.

Labeling & packaging postponement

Labeling postponement can be described as a situation where a standard product is stocked and labeled differently based on the realized demand (Swaminathan & Lee, 2003). In practice, the concept has only recently been coming to forefront and its implications throughout today's industries have caught relatively little attention. What is somewhat surprising is how seldom labeling postponement has been implemented in paint production. Helander (1999, 228) suggests this is due to the fact that without labels it is difficult to determine the product type without opening the cover of the paint can. Because there are only few examples of practical applications of labeling postponement, and the manufacturers know little about the implementation of the concept, the feasibility of such operating systems for the paint industry warrants analysis.

Packaging postponement relates basically to a situation where standard product is stocked and then packaged differently based on the received customer order. In practice the varying element

can be for example the container, in which the product is sold. This type of postponement starts generating savings in the final stages of the supply chain because only the final packaging is postponed.

Manufacturing postponement

Changing the sequence of activities to delay changes in form or identity has been renamed *manufacturing postponement* in the recent academic literature (Garcia-Dastugue & Lambert 2007; Bowersox et al. 2007). According to Garcia-Dastugue & Lambert (2007, 57), this has resulted in a stream of research called design of product and processes for postponement. The practical applications of this postponement type are typically based on pre-manufactured modules and easily attachable components, whereas examples vary from Volvo cars to skiing jackets. Manufacturing postponement often requires changing the design of the product and the manufacturing processes, and might require changing the location where activities are performed in the supply chain. Because this type of postponement always affects the structural design of manufacturing, it also starts generating savings directly after the primary manufacturing of modules has been finished.

Time postponement

The delay of forward movement of products has been referred to as: geographical postponement (Inkiläinen 1998), logistics postponement (Bowersox et al. 2007) and time postponement (Zinn & Bowersox 1988). As the issue concerns the geographical location of the product in the continuum of time, the child's many names all make sense in their own way. This specific category of postponement operates in a manner directly opposite to that of form delay strategies. The basic idea of time postponement is to delay product location or positioning until receipt of the customer orders. This considered, it is no wonder that this specific view of postponement resulted in a stream of research on inventory centralization (Maister 1976; Tallon 1993; Inkiläinen 1998).

The key logic behind geographical postponement is to complete manufacturing in the most economical manner, but avoid the risk of poor distribution by maintaining inventory in a few centralized stockpiles (DCs). Thus, a full assortment of products can be maintained at the central stocking location. By exploiting a basic principle of inventory management, time postponement increases the capability to fill orders completely, because the risk associated with anticipatory forward distribution of goods to field-stocking locations has been postponed. What later comes

understandable is why time postponement is of low relevance in the context of our research, and why we don't discuss it more thoroughly.

2.3.1. Postponed manufacturing

Postponed manufacturing is a specific combination of the three generic types of postponement: form, time and place postponement. Final processing and manufacturing activities are postponed until customer orders have been received (time postponement) and are performed from central operations in the international supply chain (place postponement), to include customer- and country-specific characteristics in the finished product (form postponement), frequently followed by direct delivery to retailers or customers (Van Hoek 1997, 63). In the postponed manufacturing systems customization of products can be separated from the primary processing or manufacturing of base materials. This separation enables basic processing to focus on large economic runs of standard products or base material. From the moment when primary manufacturing modules have been finished, generic modules are kept in store until orders have been received. This type of system also starts generating savings from that moment on. Frequently, packaging and labeling follow the final assembly and manufacturing. Postponed manufacturing thus generates savings on top of the savings from packaging postponement and from an earlier moment. It also leads to savings on top of the savings from time postponement. Van Hoek (1998) argues it can do so because savings are not only based on postponing the forward movement and handling of goods but also on the postponement of manufacturing activities. Well-known examples of postponed manufacturing systems include Dell Computer, which nowadays operates a SC strategy very close to pure postponement, and only designs its product in advance.

Out of the discussed postponement types many have already been applied within the European paint industry with varying success. While some have proved to be unfitting for process-based production and only generating extra costs, others have instantly turned out to be true sensations and quickly become industry standards. Later on in the empirical part of this study, we will have a closer look into the possibilities of applying labeling postponement within the supply chain of the case company. The concepts of time-based competition, first introduced by Stalk (1988) and mass customization introduced by Davis (1987) are next shortly discussed, because they use postponement as a tool to achieve a competitive advantage (Helander, 1999).

2.4. Time-Based Competition and Mass-Customization

Time-based competition refers to "the ability to deliver a customized product within a shorter elapsed time than can competitors in the same market, and is usually measured in terms of delivery lead time" (Helander 1999). Hence, time can be thought to represent an expanded pattern for corporate success. In addition to the traditional pattern of providing the most value for the least cost, the expanded pattern offers the same in the least elapsed amount of time. This is why the role of information is emphasized and why companies are increasingly keen on all kinds of market information. Bowersox et al. (2007, 11) think it is the increased availability of low-cost information that has created *time-based competition.* According to Helander (1999) a time-based competitor creates competitive advantage based on three competencies. First, *time-to-market* is the ability to develop and introduce goods and services more quickly than competitors. Second, *time-to-customer* is the capability of supplying goods and services quicker than competitors. Third, *flexibility* means tailoring services more exactly according to customer needs than do competitors. Thus, these qualities should be achieved through postponement.

Another market trend, mass-customization, is "the capability to produce customized products while achieving the cost benefits of mass production" (Cravens 1994, 213). In order to enhance product offerings, many organizations are altering their supply chains to accommodate mass customization processes (Boone et al. 2007). It has also been discussed, if customized products should have a higher price than basic products. Furthermore, Feitzinger and Lee (1997, cited by Helander 1999) have developed three organizational design principles, which together form the basic parts of an effective mass-customization program. First, a product should consist of independent modules that can be assembled easily and inexpensively. Second, manufacturing processes should consist of independent modules that can be moved or rearranged easily to support different distribution-network designs. Third, the supply network should provide the flexibility to take individual customers' orders and quickly deliver the finished customized goods (Helander 1999, 227).

While every company wishes to produce exactly what customers want at the proper place and time they wish to consume, these two concepts reflect the new market requirements for today's manufacturers and distributors. Out of these two, mass customization is the more relevant one in the context of the case study and the theoretical framework build to support it. For the case company it is often both local and international competition that is faced and fought against. Out

of the numerous competitors on the same market many companies are often local operators having their product offering available to the consumers. And because delivering products within a shorter elapsed time than local competitors is often unachievable and more or less unjustified, it naturally makes no sense for an exporting company to especially stress the importance of time-based competition. This is why we from hereon mostly concentrate in the theories, features and applications associated with mass-customization.

Companies can of course choose not to implement postponement. That decision may be based on various reasons and variations in the applicability of postponement. Not all products and processes may accommodate postponement. In the chemical and processing industry where Tikkurila operates, for example, many processes are not amenable to separate in a primary and a secondary phase. This kind of inseparability shuts out the potential of the previously discussed theories and practically leaves no room for the benefits achievable through postponed activities. The next section will further explain why postponement is a viable strategy only under certain circumstances, and how the modularity of production supports it, while some other operating characteristics undeniably speak against it. We also describe and list the most important factors that favor the applicability of form postponement.

2.5. Factors That Affect the Viability of Postponement

One of the interviews conducted outside of the paint industry disclosed interesting realities concerning the viability of postponement in general. It is by no means said that postponement strategies are always the right choice or applicable under all conditions. The European Pharmaceutical industry has its peculiarities and is also a good example that displays the importance of operating characteristics when considering the viability of postponement. Because the industry is under national authority's supervision, the manufacturing companies, such as Orion Pharma, have to deal with strict regulations, and specifically apply for a country specific marketing authorization for each product[2]. These authorizations then, are only granted for the medical products in the exact form that they leave the manufacturer, with no exceptions or room for applied solutions[3]. Here, the given regulations play an influential role, and by affecting the

[2, 3] Interview with Johanna Hamberg, Head of Document MGT and Labeling, Orion Corporation

operational standards of the whole industry, practically close out all the possibilities of postponement.

2.5.1. The important role of operating characteristics

Van Hoek et al. (1998) have compiled a list of operating characteristics relevant to assess the viability of postponed manufacturing. The basic rationale is that operating characteristics favoring either postponement or speculation represent forces relevant to the structuring of supply chains. This reasoning ties in with the focus of one of the hypotheses formulated by Bucklin (1965), which focuses on the role of operating characteristics. It posits that heavy, bulky, and inexpensive products are likely to flow through channels with more intermediate, speculative inventories than products with the opposite characteristics. This section will examine the set of operating characteristics and clarify their role in the viability of postponement. We start the overview with modularity.

Modular production

If customers demand delivery with a short lead time, having modules with standardized interfaces is generally desirable. A modular product design allows for the rapid final manufacturing of customized products at low processing costs, and has been mentioned as one of the most efficient options of achieving the required amount of customization. This is something that companies have, in fact, become aware of. During the last two decades, companies have increasingly created modular components that can be assembled in a wide variety of configurations and designed platforms that can be shared by a family of products.

Feitzinger and Lee (1997, cited by Van Hoek 1998) name three advantages of a modular product design. The first is standardization of parts combined with the postponed differentiation of products. The second is that total lead time can be shortened because modules can be manufactured simultaneously. The third advantage is that a company can isolate potential quality problems more easily. Van Hoek (1998) presents, how at the logistics-product design interface, modular production contributes to "design for logistics". Inventory cost (storage space and interest costs) and transportation costs are associated with work in progress. Figure 2-4 displays work in progress in a hypothetical flow of goods, passing from purchase/input through transformation, assembly, and delivery. What is noteworthy here is that products (e.g. paint sales

items) in progress may decrease through transformation and increase through assembly and distribution (including the assignment of products to specific markets in the distribution process).

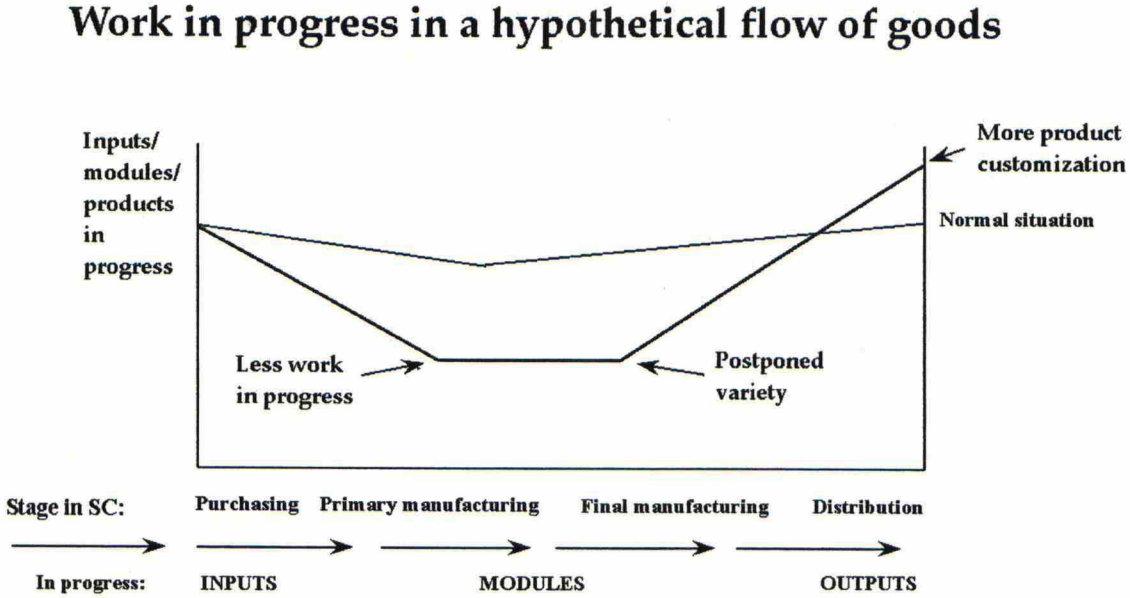


FIGURE 2-4 Design for logistics (adapted from Van Hoek 1998)

As Van Hoek (1998) puts it, it is "logistics friendly" to design products and processes to decrease inputs as soon as possible and to increase variety as late as possible. Modular production can enable this by transforming inputs and materials into parts with a high commonality and assembling or customizing them into a wide variety of products (sales items).

To summarize, modular product design contributes to low processing costs, which limits diseconomies of scale resulting form the postponement of final manufacturing. Modularity usually helps reducing total inventory when implementing postponed manufacturing and creates the possibility to adjust modules on a (continental or regional) market level. Thus, the company can maintain efficiency while assuring flexibility in responding to customer demands. On top of this, modular production can enhance product innovation (Van Hoek 1998). Customization in response to customer orders may also stimulate innovation at the level of modules and of new combinations of existing modules. The relevancy of modular design in paint products has more to do with the chemical compounds and colourants used in paint tinting than the containers and labels surrounding the actual products. Still we can think how modularity can be applied in the design and layout of the product labels. Surely, we can imagine the 'base label' and other sections of the label to be attached in different points of the SC and thus see them as modules of the actual product label. In this way modular design plays a significant role also later on in this thesis.

Other relevant operating characteristics

When classifying postponement applications, the literature (Cooper 1993; Van Hoek 1998) often lists three product characteristics: branding, formulation, and peripherals. Also the importance of primary product characteristics is commonly recognized. Van Hoek has later expanded the list by adding value density and required speed of delivery (as in Table 2 below). Rapid delivery can conflict with postponement. Postponement may call for different processing times after receiving customer orders, because final manufacturing (additional labeling) has to be done. Value density, on the other hand, drives centralized production and distribution. The relevance of the two added factors is evident in the example of paint manufacturer like Tikkurila, where most of the products have a global branding and homogeneous formulation, whereas peripherals (including documentation and labeling) vary between market areas. These characteristics all argue for a solution structured as a deferred labeling system.

TABLE 2. The role of operating characteristics in designing a supply chain (Van Hoek 1998)

	Unicentric Central production & distribution	Bundled manufacturing Design product so that customization can take place at the latest possible stage of production process	Deferred assembly Final assembly and final configuration in central warehouses	Deferred packaging Labeling and packaging at regional warehouses
Brand: is it global?	Yes	Yes	Yes	Yes
Formulation: is it common to all markets?	Yes	No	No	Yes
Peripherals: are they common to all markets?	Yes	Yes	No	No
Value density?	Yes	Yes	Yes (medium)	No
Speed of delivery?	Neutral	Neutral	High	High
Benefits	Economies of scale in production & distribution	Rationalization of components' range to simplify inbound transport	Economies of scale in production and distribution savings in inventory with high customer service	Inventory savings
Examples	Marlboro cigarettes	Sony televisions	PCs, Electronics	Food industry
Position of final manufacturing	Global plant	Europlant	European distribution center	Regional warehouse

Also commonality is related to the principle of design for logistics, which was explained in the previous section. Zinn (1990) and Van Hoek (1998) both draw attention to the principle of risk pooling. Zinn stated that the number of modules may be smaller than the number of finished products through commonality. Storing modules instead of finished products pools inventory risks across a smaller number of SKU's, and concurrently generates saving through lower inventory value. This effect of shift in inventory value is further discussed later on in the section that introduces the term time-based postponement and concludes how centralized inventories and mass-customization operations help in fighting the mounting variety of most internationally marketed consumer goods. Before that we take a general look at the different factors that support the viability of postponement.

2.5.2. Factors that favor form postponement

In the previous studies (Zinn & Bowersox 1988; Swaminathan & Lee 2003) factors that affect the advantages obtained with postponement have been described, but a holistic view has been missing. In this section, three types of factors that affect the benefits and costs associated with labeling postponement, and form postponement in general, are discussed in detail. Based on Helander's definition of form postponement (see pg. 10), also some requirements of mass customization and time-based competition have been taken into account. Our assessment concerns a situation where sales items are held in non-finished (nor committed) status, and some sort of postponed manufacturing is applied. The goal is to define and categorize all the factors that the attainable savings through postponement can be attributed to. In other words, we now focus on the factors that positively affect the viability of postponement, and categorize them into three groups: product factors, logistical factors and market factors.

As to *product factors*, an increased number of product introductions, wide product range and short product life cycles favor postponement through the increased value of common components (Helander 1999). In addition, high product value increases the potential of postponement through the capital required for inventories (Zinn & Bowersox 1988). Also, postponement is more effective when products are negatively correlated; in other words, they are not substitutes (Lee 1996, cited by Helander 1999). Except for maybe for high value, these are all characteristics that also fit well to describe the majority of products included in the product assortment of an international paint manufacturer.

Logistical factors are those manufacturing and distribution processes under the control of the firm. These include the sequence of operations performed to customize the product, the network structure of the supply chain (manufacturing and distribution sites). These factors greatly affect how cost-efficiently and quick companies are able to customize their offerings to meet the customer wishes and need. For example, Nokia has arranged all of its product-customizing operations as close to the target market and the end-customers as possible, and thus avoids cross-continental shipping of all of its finished products already customized for specific markets.[4] With regards to logistical factors, the value of common components depends on stockout costs, lead time to replenish stocks, and freight costs. As uncertainty, delivery times, and inventory holding costs increase, so do the benefits of standardization (Helander 1999, 230).

According to Swaminathan and Lee (2003) *market factors* are those related to customer demand and service requirements. These parameters include demand fluctuations or variance, correlation in demand across the different products, lead time and service requirements for customization (which affect the penalty cost for stock-outs or late deliveries). As for other market factors, the gap between ideal and available products, demand for unique products and a price premium obtained with customization also favor form postponement (Helander 1999). All these factors that favor form postponement are summarized below in Table 3.

TABLE 3. Factors that favor form postponement. (Adapted from Helander 1999)

Product factors	Logistical factors	Market factors
• Wide product range • Short product life cycles • High product variety • Products are not substitutes • High product value	• High inventory holding costs • Long lead times in deliveries • High freight costs • Multiple-stage delivery network • Demand uncertainty (stock-out costs)	• Customer demand fluctuations • Gap between ideal and available product • Demand for unique products • High price yield for customized products

[4] Interview with Jari Saarenpää, Head of DSN Management at Nokia Corporation

In process-based industries such as paint and coatings, some processing cycle times may last longer than the customer order lead time, while the process cannot be decoupled at an intermediate stage. So, apart from the tinting and coloring of decorative paint products, the product design of this industry doesn't really allow for postponement in manufacturing. In addition to product and process design (continuous or decoupled process), the implementation of postponement naturally affects also the supply chain structure, as postponement activities will most likely be placed close to the market (Van Hoek 2001, 163). To get a better idea of where postponement is applicable and might turn out useful one has to accurately know, and be able to picture the structure of the supply chain in question. Therefore, we next bring forward the much-explored theme of supply chain mapping.

2.6. Mapping the Supply Chain

Visualizing, tracking, and managing supply chains all become more complicated as firms pursue outsourcing strategies and as firms' supply and delivery systems become increasingly global. Supply chain maps can depict organizations, flows, facilities, and/or processes, and come in a number of shapes and styles.

A *supply chain* map is a representation of the linkages and members of a supply chain along with some information about the overall nature of the entire map. A *strategic supply chain* map respectively, is distinguished by its direct tie-in to corporate strategy (Gardner & Cooper 2003, 46). This type of map can be either an integral part of the strategic planning process or a tool for implementing the supply chain strategy. Strategic supply chain maps might simplify the spatial relationships to a great extent, but the essence of the environment must be captured. While a strategic supply chain map must have immediacy, the goal is to exceed our individual reach and exceed our individual vision. The essence of strategy is the communication and implementation of the firm's vision.

Gardner and Cooper (2003) list several reasons why a strategic supply chain map can be useful. They see that a well executed map can enhance the strategic planning process, case distribution of key information, facilitate supply chain redesigns or modifications, clarify channel dynamics, provide a common perspective, enhance communications, enable monitoring of supply chains strategy, and provide a basis for supply chain analysis. Many people tend to think and learn in pictures and feel that "a picture is worth a thousand words." Thus, a map can be quite useful in

understanding a firm's supply chain, for evaluating the current supply chain, and for contemplating realignment of a supply chain, as in the case study section of this thesis. When analyzing a supply chain, overlaps and duplication should also become more apparent through visualization. Thus, with a good map, rationalizing the supply chain becomes easier. Figure 2-5 illustrates the informational value of a supply chain map and sets an exemplary map design that we further adjusted to describe the case company's business environment and SC relations later on in chapters 4 and 5.

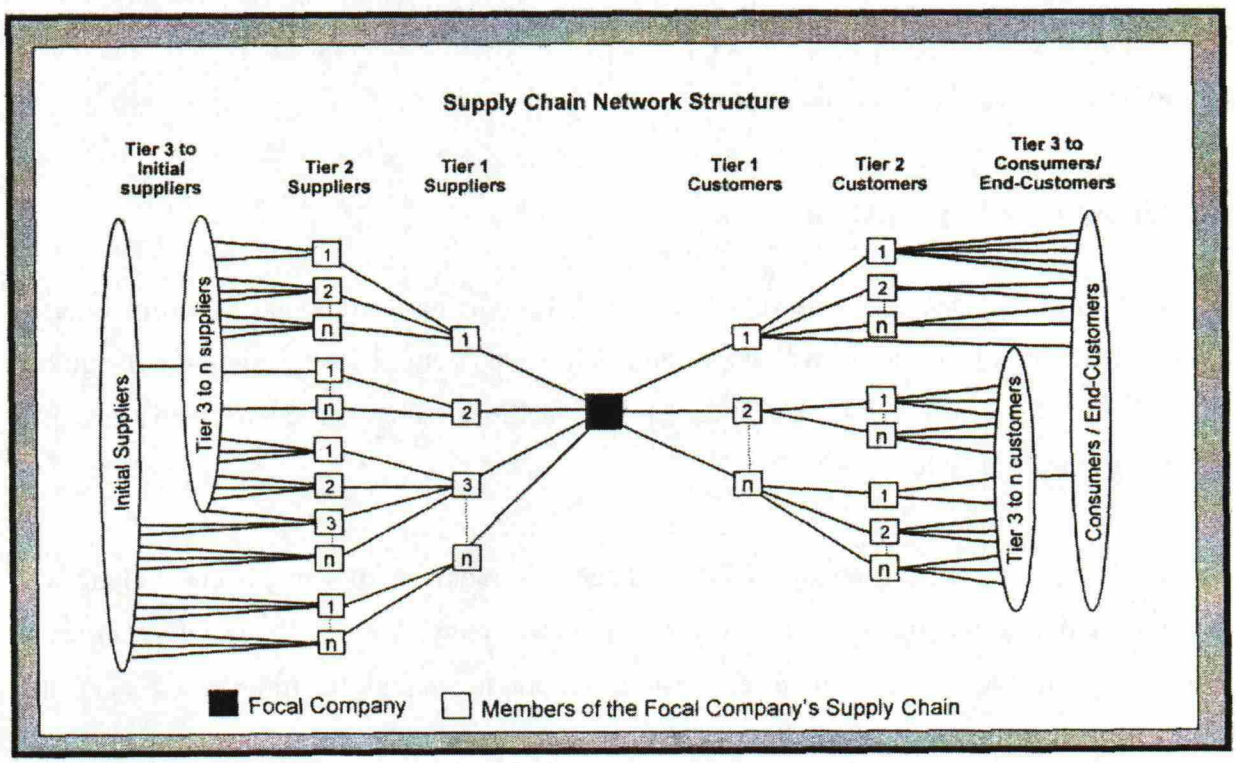


FIGURE 2-5 Supply chain network structure (Lambert, Cooper, and Pagh 1998, p. 3)

According to Gardner and Cooper (2003) a good strategic supply chain map should be easy to build and use, comprehensive yet not overly detailed, strategic in focus, intuitive in use of visuals, effective in building alternatives, and well integrated into the strategic planning process. They also demonstrated the need for supply chain mapping conventions that are necessary for instant recognition of the type of map and purpose of the map, yet permitting customization by the user. Some of the presented conventions (see the above Figure 2-5) are later used in the mapping of Tikkurila's current supply chain.

While SCM takes an overall perspective of how processes work together between companies, it uses mapping as a visualization tool. And because the definition of supply chain management has

evolved into one that spans functions or processes within firms and across firms from the raw materials to the end consumer, some boundaries must be set for drawing particular maps for supply chain mapping to be useful. If a map would truly include all customers and suppliers at all tiers, it could be a very complex – even endless – map. Thus, to keep the map as simple as possible supply chain mapping may also exclude some non-critical entities (Lambert et al. 1998).

The reason why we are especially interested in supply chain mapping is because a strategic supply chain map will offer a basis for supply chain redesign or modification (Gardner & Cooper 2003). The map can be either descriptive, "what is," or prescriptive, "what can be", and thus helps with the possible modification process. In Chapter 5 we will bring together prescriptive maps of alternative future SC structures for Tikkurila and make suggestions on how the company should proceed towards these modified structures of their supply chain in Southeastern Europe. The created maps provide managers with a comprehensive view of the international distribution channel under examination, and point out features such as the points for product differentiation. Moreover, the maps helps to visualize the supply chain and identify areas for further analysis or show obvious inefficiencies not as easily visible by examining on a small segment of the supply chain. Next, some central distribution related themes of this thesis are discussed in more detail.

2.7. Structural and Operational Dimensions of Distribution

Of the many theories and frameworks concerning distribution and logistics, the majority can be grouped into three categories based on the main issue on which they focus: (a) number of echelons, (b) centralization vs. decentralization and, (c) the degree of postponement. We started by examining the operational dimension of postponement, and the theories behind it. In the next sections we will focus our attention more on the two structural dimensions that distribution can be conceptualized as, e.g. the number of echelons and the centralization.

Our first dimension defining the structure of distribution is the number of echelons, which describes the closeness of the producer (factory) to the consumer. This distance is shortest of course if the producer ships the product directly to the end-user. We call this structure a direct (factory) delivery, as it has no storage points or inventories along the distribution chain. A system with one storage point is called a single-echelon structure. Note that a single-echelon structure does not necessarily involve more than two actors, given that the producer has its own inventory or a couple of inventories we also call an echelon. Accordingly, a system with a minimum of two

storage points at successive echelons is called a multi-echelon distribution system. So-called vertical integration (ownership of successive echelons) does not "shorten" the distribution structure. Thus, a factory-owned supply chain with several physically separated hierarchical storage points is not called direct but a multi-echelon system. In this thesis, we regard the number of echelons (stocking levels or layers) as the criterion, which separates the direct distribution structure from the indirect structures. This will become more apparent later on in chapter 5.

Alderson (1950) was the first to note that products tend to become differentiated as they approach the point of purchase, i.e., as they flow down the supply chain. Although this "differentiation" improved the marketability, the "manufacturability" of the products becomes more complex. This is why the positioning of the *customer order decoupling point* (CODP) becomes a strategic issue for all manufacturing companies, no matter what industry. The principle of CODP has strong relations with the previously discussed postponement strategies in the sense that it divides speculative and postponed operations in the supply chain. Respectively, just like customizing activities, it can be positioned anywhere along the supply chain. Van Hoek (1997, 65) identifies a list of six generic CODPs:

1) Engineering to order, as in construction
2) Purchasing to order, as in high-end electronics
3) Make to order, as in restaurants
4) Final manufacture/assemble to order, as in some personal computers
5) Packaging and labeling to order, as in some packaged foods
6) Shipment to order, as in retailing

A seventh CODP – adjust to order in the retail channel – can be added, given that downstream in the retail channel, final adaptations can be made on the basis of customer orders (like the tinting of decorative paints or making of fresh salads). The further the CODP is positioned upstream, the more the scope of activities performed on order increases. This is displayed in Figure 2-6, which positions types of postponement in relation to generic CODPs. Indicated between bars is the area of postponed manufacturing in make to order and assemble to order situations.

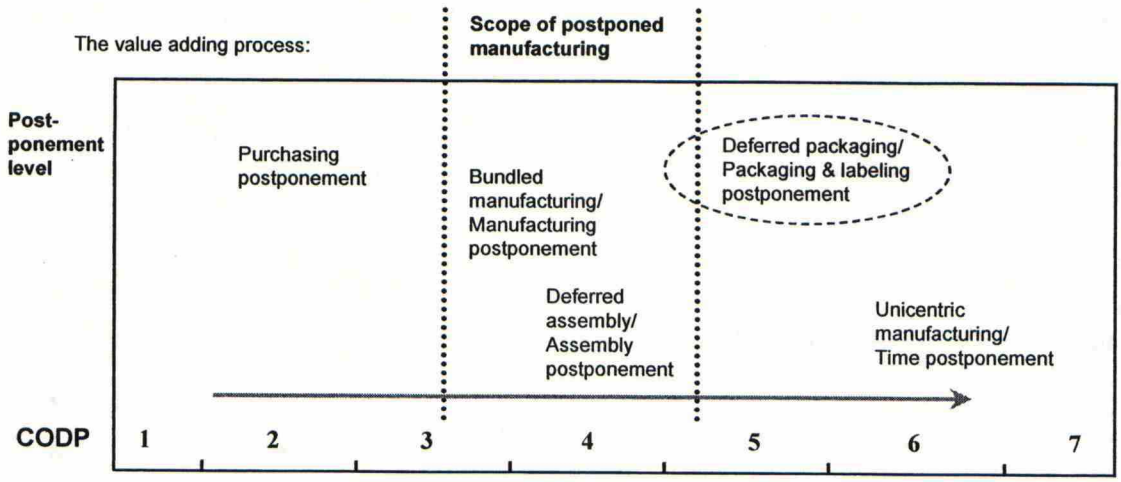


FIGURE 2-6 Postponement types and the CODP (adapted from Van Hoek 1997)

The case study section, later on, will focus on the feasibility of the encircled fifth CODP level in the operational environment of an international paint manufacturer and its practical implications. The next sections will briefly discuss the development of distribution and marketing channel theories.

2.7.1. The evolution of distribution structures

Today's manufacturers continuously face paradoxical situations; they want to concentrate on core activities on the other hand, but have to be totally customer-oriented on the other. Inkiläinen (1998) suggests that the concept of value-adding logistics (VAL) will offer a solution to meet those requirements; value-adding activities (e.g. late customization) are transferred from production sites along the supply chain, closer to the customer and the targeted markets.

Because of various cultural and business-related reasons, multinational firms have historically favored independent subsidiaries in their European operations. With their own distribution outlets they have been able to avoid trade barriers such as import duties, import quotas or possibly restrictive national standards. Inkiläinen (1998) suggests that the distribution structure of international companies normally develops through the following five stages:

1) Direct Export
2) National Warehouses
3) Gateway
4) European Distribution Center
5) VAL Center

According to Inkiläinen (1998) there are two generic trends in the evolution of the distribution structure: (a) change to a more centralized distribution and (b) to a more customized or differentiated markets. Normally, *direct export* from the factories to the target markets is performed through independent distributors in each country. This approach is typically used in companies that are at early stages of their company or product life cycle. Direct export can also be seen as the appropriate strategy when entering foreign markets with unstable business conditions or high risks. Countries that have just recently won their independency would present a good example of such markets. Additional revenue gain without high market entry costs is one benefit of this approach, but possessing a little or hardly any control over the distribution may in the long run become an obstacle to rapid market growth.

National warehouses become feasible when sales volumes have risen and there exists a user group with after sales service needs and preference over the firm's products. A local presence increases the controllability of markets and makes the firm more responsive to market fluctuations. Manufacturers experience this type of market entry to engage additional resources and to complicate the coordination of activities between various warehouses and factories.

Gateway routes all goods from various factories through one point of entry. A good example would be an importer with exclusive rights to a trademark and thus all the goods under this brand entering the market in question. This approach facilitates the active role of distribution and lowers the cost of logistics operations.

A European Distribution Center (EDC) has the potential of decreasing costs of distribution further and at the same time at a higher level of customer service. Coordination and control of distribution operations is presumably more effective. Complications may temporarily arise with fixed investments and personnel when old structures are rearranged. If capabilities for modular assembly and late customization, like additional labeling, are added to an EDC, the services to customers become more responsive. Then the center changes also by its nature and can alternatively be called a Value-Added-Logistics center (*VAL center).* Rationalization of manufacturing and transportation processes brings cost savings to the firm, better responsiveness and a higher level of customer satisfaction. In a way, *VAL centers* located around Europe integrate the push principle of component manufacturing with the pull principle of market demand.

The demand for highly customized service has increasingly transformed modern distribution warehouses into facilities that specialize in performing value-adding services. Warehouses can postpone final product configuration by completing packaging, labeling, or even light manufacturing. This secondary production is normally located closer to the end-user market to shorten the time and geographical gap between the supplier and the customer. For example Dole, a big food distributor, is known for its deferred labeling applications in its European distribution channel. Its strategy builds on the strategy of holding some of the inventory as *brights*[5], meaning that products are not committed to specific customers or carton configuration during processing. Thus, imported fruits and vegetables, shipped to Europe in brights, can be later labeled according to the brand and market under which and within they are sold. Other famous examples of VAL centers include the earlier mentioned Hewlett-Packard's employment of decentralized final customization of their DeskJet printers for the European and Asian markets. What is important about the structure of the distribution network, and the possible value adding services, is that it is always case specific whether it is rational to defer parts of the manufacturing process. Postponement is always an individual choice, and not the one and only way to succeed internationally. For example Orion, a successful Finnish Pharmaceutical company, employs a centralized structure for its production and only ships finished product packages out of the gates of its manufacturing plants[6].

2.7.2. Marketing channel theories

If the traditional marketing channel theory is applied, the design of a distribution structure is based on the geographical distance between a producer and the customers. The marketing channel theories focus on functions performed by various actors of the channel, gaps between producer and customers, and the use of intermediaries in the channel. Thus, they are very much relevant in the case of postponed activities and the context of our case study closely related with structures of international distribution.

Traditionally marketing channel theories do not distinguish between industrial product and consumer product and both areas are handled identically. In the paint industry discussed more thoroughly later on in this thesis, then again there are remarkable differences between the industrial sector and the consumer sector of the markets. Also, according to the traditional

[5] Brights are cans without labels.

[6] Interview with Johanna Hamberg, Head of Document MGT and Labeling, Orion Corporation

marketing channel theories, producers (sellers) are strong and they are supposed to find large number of faceless customers. Kind of a gap can be identified between a producer and the customers. To fill this gap, in the past the main aim has been to create value (availability) for potential customers and in accordance with theories from the last century this is best done by increasing the number of intermediaries and warehouses. Some fifteen years ago, Abrahamsson (1993) wrote in his famous article that the number of warehouses was long believed to have an effect on customer service.

The distribution theories have traditionally concentrated on distribution of industrial goods, and only recently there has been more discussion taking notice of the consumer aspects. Most of the fundamental theories concerning distribution have been presented during the late 20th century and they are mainly based on conventional marketing channel theories. One of the first and most detailed theories of distribution was presented by Bucklin (1965). According to Bucklin, the workload of any function can be shifted to another function without affecting the total output of the channel. In other words, his idea was that the distribution channel consists of several interchangeable functions. As an example, he mentioned the possibility to use inventories to level out the fluctuations in production volume and additional costs caused by cyclical demand. In accordance with Bucklin's theory, the workload of the channel will be reallocated among various functions so that total cost of the whole channel is minimized. This thinking supports the idea of generating considerable savings through increased flexibility, and sets a foundation for our framework and the philosophy of increasing profitability by re-sequencing activities.

For our future use when designing the to-be SC structure, we sum up the key elements of marketing channel theories, which argue that a distribution channel contains a number of warehouses, if (Inkiläinen 1998):

- The number of customers is large
- The customer-structure is geographically spread out
- The industrial concentration of the market is small
- The customers purchase small volumes
- There are many competent middlemen available
- The products are standardized

Next we'll take a look at the other structural dimension of distribution and review on how the degree of centralization can affect the distribution system and the service level the channel observable by the customers, and other downstream stakeholders.

2.8. Centralization in the Supply Chain

The uncertainties of the market, both on the end-customer and the supply side, often requires the firm to maintain safety stock for its products. The level of safety stock maintained for each product is a function of the levels of uncertainty in the demand and/or supply of the product and the degree of protection the firm desires against stocking out. Thus, maintaining larger stocks of product in inventory increases the probability that an item will be available when requested by the customer. This is understandable considering that higher safety stock levels improve the chances of meeting customer demand, while lower levels reduce the chances.

In general, the centralization of product inventory will reduce aggregate safety stock levels in an uncertain environment. However, the lower level of decentralization may reduce proximity to markets and, hence, customer service. Reductions in customer service on the other hand, can be minimized through improvements in outbound transportation or in order processing performance. The total benefits of centralization can be maximized when product consolidation, mass customization and transportation performance improvement are conducted simultaneously, in a European distribution center, for example. Also the costs associated with inventories can be lowered through centralization. Holding inventory at a lower value reduces the direct variable costs associated with inventory such as cost of capital for the assets employed, but also the costs associated with the risk of products becoming out-of-date or otherwise obsolete are much lower. If product does become obsolete, it is basically better for the supply chain to write off product at the lowest cost. In other words, products held by the retailers usually will have a higher cost of obsolescence than products held by the manufacturer. This considered, it is very important to analyze which product lines are of such nature that it is reasonable to push them forward in the supply chain and have decentralized stocks for them along the channel.

Research has also shown that by centralizing the product safety stock to fewer locations, the aggregate safety stock level can be reduced. This is due to the "pooling" effect of the forecast error. In other words, the product shortages experienced by one inventory location are offset by the surpluses at other locations. As a result, the desired level of customer service, defined as a

probability of a stockout, can be maintained with lower centralized stocks when compared with multiple decentralized inventories (Tallon 1993). Maister (1976) was one of the first supporters of this special relationship between inventory centralization and the aggregate safety stock.

Later this phenomenon of reduced demand variability resulting from centralization has been referred to as the "Square Root Law" (SRL), since the standard deviation of demand for the centralized facility is the square root of the sum of the variances of the demands for the decentralized facilities. Mathematically, the square root of the sum of the variances is less than the sum of the individual standard deviations.

As an equation the SRL can be expressed as follows: $$\sigma_{dc} = \sqrt{\sigma_{d1}^2 + \sigma_{d2}^2}$$

where: σ_{dc} = standard deviation of demand of the centralized inventory

σ_{d1}^2 = variance of demand of inventory 1

σ_{d2}^2 = variance of demand of inventory 2

and: $$\sigma_{dc} \leq \sqrt{\sigma_{d1}^2} + \sqrt{\sigma_{d2}^2}$$

The smaller standard error for the centralized location enables the firm to provide similar customer service levels at a relatively lower level of aggregate safety stock. Tallon (1993, 187) notes that the more locations are centralized, the greater the potential for safety stock savings from centralizing inventory to fewer locations. As an example, we consider the product demand data for three stocking locations presented in the Table 4. Given a constant level of stockout protection for all facilities, centralizing the product provided by locations 1 and 2 into a single facility would reduce the required level of safety stock for both facilities by approximately 26% (from 494 units to 368 units). Respectively, the aggregate safety stock level could be reduced about 35% (from 1,152 units to 754 units) if all three locations were centralized into a single facility taking care of the warehousing. According to Tallon (1993), the same percentage of inventory savings would be realized, regardless of the level of stockout protection, or k value, selected.

TABLE 4. Safety stock example with no supply lead time uncertainty

	Location		
	1	**2**	**3**
Average Period Demand (units)	600	1000	1300
Standard Deviation of Demand	100	200	400
Desired Stockout Probability	.05[a]	.05	.05
Required Safety Stock (units)	165[b]	329[c]	658[d]

[a]k value = 1.645 from the normal distribution table

[b]1.645 x 100 = 164.5 units of safety stock

[c]1.645 x 200 = 329 units of safety stock

[d]1.645 x 400 = 658 units of safety stock

Further research has shown that the relationship between inventory centralization and aggregate safety stock level is a function not only of the respective standard errors but also the correlation of demands between the stocking locations (Tallon 1993, Inkiläinen 1998). Their model indicates that the more positive the correlation in demand between the stocking locations, the greater the standard deviation of demand for the centralized stocking locations (distribution centers), and the lower the savings in aggregate safety stock from centralization. What this means in practice is, the more negative correlation of demand between the locations, the higher the inventory savings from centralization. The effect is illustrated in Figure 2-7, where the impact of sales correlation on the percentage savings in aggregate safety stock resulting from the centralization of two stocking locations is clearly noticeable.

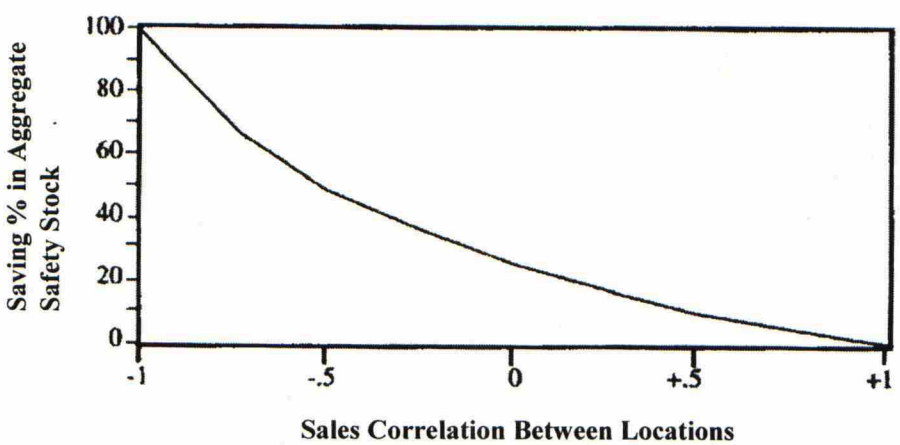


FIGURE 2-7 Impact of sales correlation on aggregate safety stock savings (Tallon 1993, p.189)

In Chapter 5 the stocking costs and the significance of centralization are assessed further, and the relevant cost effect of transportation, inventories and deferred labeling activities is evaluated in each of the case company's future scenarios. We will also present our recommendation for the future distribution structure, and its degree of centralization.

2.9. Summary of the Theoretical Concepts

In this last section of the second chapter we will sum up the theories so far discussed, and try to organize them in logical way in the context of this research. The aim is to clarify each theory's relevance in the context of this study and the central points related to mass-customization and postponement applications. But before this, it is time to conclude our quest for the appropriate postponement concept, which would extensively enough take into account all the relevant aspects of an international paint manufacturer's business environment and the background of our research problem.

Also in the context in labeling postponement, it is necessary to consider the full concept of postponement vs. speculation as suggested by Bucklin (1965). Practically, if there are products in inventory at retail stores, then the SC is using speculation. We believe that this thinking confirms Bucklin's argument that postponement and speculation are not separate concepts but in a SC context they must be used together. Thus we looked for postponement concepts that had a broad view on these theories and jointly discussed both postponement and speculation.

In real life, there are situations where multiple members of the supply chain will be able to postpone activities until the end-customer places the order. Still, a make-to-consumer order environment is not possible for most products. For example, in the case of packaged consumer goods, the SC will not be able to postpone activities until a consumer places an order. Obviously, the consumer expects the product to be available at the retail store. We unfortunately found out that the majority of applied research in postponement is focused on the next-tier customer, which could result in sub-optimization. This is understandable, because much of the cited research in postponement was completed before management and academics were taking a supply chain perspective. SCM requires a focus on the end-customer in order to be more responsive to changes in end-customers' demand. Therefore, we were delighted to find the following, relatively fresh, postponement concept by Garcia-Dastugue and Lambert (2007) that actually extended postponement research to a multi-firm setting.

Time-based postponement

Interorganizational time-based postponement, a term favored by Garcia-Dastugue and Lambert (2007), is the intentional delay of activities for as long as possible and includes delaying the differentiation of products in terms of form, identity, or place but it does not necessarily include changing the sequence of activities. It focuses on finding the best location to position the decoupling points and should include all decisions that increase the cash-value of the product such as manufacturing and logistics (Garcia-Dastugue and Lambert 2007, 60). What makes the concept interorganizational is that, according to the authors, it contributes to understanding how postponement can be used as a supply-chain-wide initiative.

In the Figure 2-8 below, the central pieces of theory applied in this study are depicted as building blocks of sort of a theory-nucleus. The broken-lined frame surrounding the theory blocks represents the idea that the illustration compiles the most essential theoretical concepts as one interconnected entity. In the figure time-based postponement is presented as a theory following time-based competition, a phenomena mainly discussed in the 1990's.

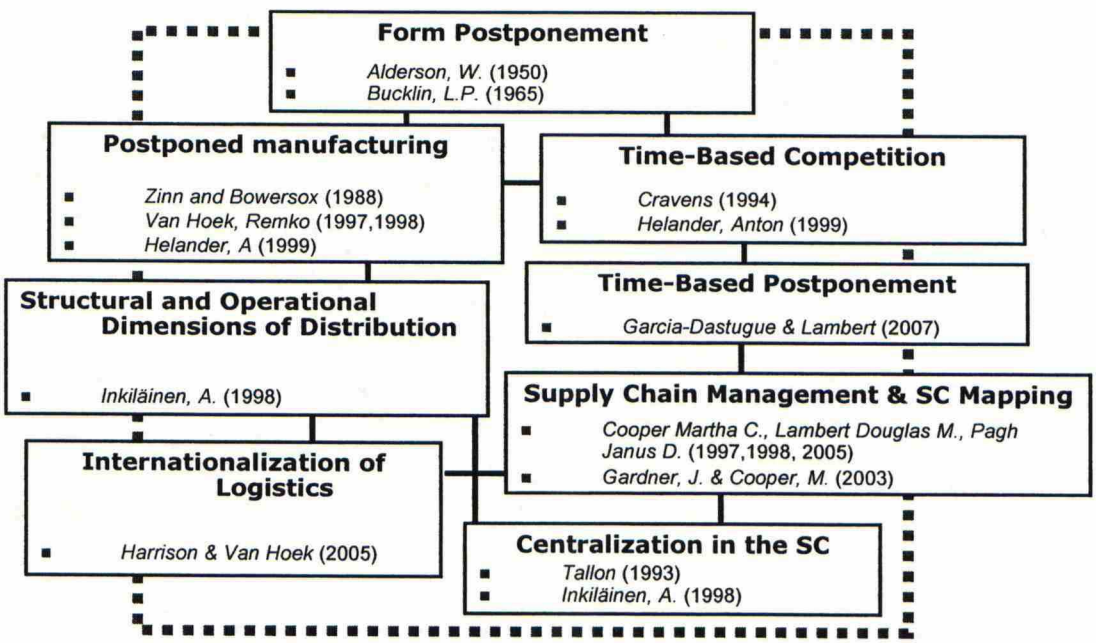


FIGURE 2-8 The central research theory in one frame

So far we have discussed theories from most of the building blocks, maybe excluding the internationalization of logistics. Before constructing our framework for the future use of managers struggling with problematical situations related with product labeling, we will have a

look at the delivery strategy decision closely related with the theories deriving from the two bottommost building blocks on the left of the frame, and shortly discuss how internationalization has had its effect on logistics worldwide.

While the previous figure compiled the central theory pieces of this thesis as one, the framework presented in the next chapter will further link these theories together and offer a logical way to approach the real-life dilemmas. The key question will continue to be: what degree of speculation or postponement should each member of the SC use in order to maximize the performance of the entire supply chain? Despite the focus on paint business, the framework can be used in the analysis of other business fields as well.

3. Responsiveness Through Labeling Postponement

In this chapter of the study, we will first assess the relevance of postponement strategies to paint industry products, based on the preceding literature review. Then we will critically review the strategies identified so far, and take a closer look into the most appealing one, keeping in mind the applicability and suitability for Tikkurila's packaging and labeling process. We also examine the alternative delivery strategies to be used alongside the concept of labeling postponement and have a look at the main principles applied in the implementation phase. Before presenting the constructed framework and its appropriate use, we shortly assess the most important factors affecting the point of product differentiation. Also the primary drivers for implementing postponement strategies will be identified.

Executives are becoming aware of the emerging paradigm of inter-network competition, and that the successful integration and management of key business processes across members of the supply chain will determine the ultimate success of the single enterprise. Managing the supply chain, and processes like delayed labeling, cannot be left to chance. The findings of Lambert et al. (1998, 14) suggest that the structure of activities/processes within and between companies is vital for creating superior competitiveness and profitability. This is why we decide on the network structure of the supply chain to be the platform, on which we start to build our framework. On top of it we will gather the structural and operational dimensions needed for the implementation of labeling postponement applications, without forgetting the dynamic nature of today's competitive environment.

Responsive manufacturing stresses flexibility and strives towards the ideal situation where companies trigger the entire design-make-ship cycle only when a clear demand signal is available. According to Bowersox et al. (2007) the vision of manufacturing, or form postponement is one of products being manufactured one order at a time with no preparatory work or component procurement until exact customer specifications are fully known and purchase confirmation is received. This innovative concept of structuring supply chains can be related to the accelerating need for simultaneous product differentiation, rapid delivery, regional product variations and competitive cost levels in many industries. Like many other industries, the paint industry is also facing the challenge of cost efficiency and product differentiation, while the internationalization of the business has made cosmetic regional product variation a crucial issue.

Why is it then that postponement strategies would provide answers to the encountered problems with exported paint products? Why should something done next week instead of now do any good in the first place, let alone ease the problematic situation of product labeling operations? The answer to these questions lies in postponement's ability to add value by providing increased flexibility. The task is simply to find the specific function within the paint industry where the theory of postponement is viable and can be implemented in practice.

For this purpose we will construct a framework that is capable of putting the concept of interorganizational time-based postponement into practice in the form of a labeling postponement application. As earlier mentioned, many features of this concept speak for the development of a supply chain network with increased flexibility. First of all, it is found upon the idea of intentionally delaying the differentiation and the forward movement of products. This can be postponing the identity of products (label information) as long as possible provided that it creates additional benefits. Secondly, the concept doesn't necessarily require a change in the sequence of the completion of activities in order to enhance the performance of the SC. Thus it supports a labeling postponement strategy that would enable the envisioned supply chain network for paint products to make the most of regional product variations and centralized inventories by applying the simple theories of form and time postponement. How the selected postponed labeling strategy suits the characteristics of Tikkurila's operations and business environment, is further analyzed in the fifth chapter.

Before going deeper into the main principles behind postponement applications and the construction of the framework, we first discuss the basic delivery strategies international companies can consider, and see which alternative best meets the conditions of postponement and late customization.

3.1. Delivery Strategies in a Global Network

In general transport costs have continued to decline over time as a relative cost item because of innovations in transport technology, the commoditisation of transport (such as container ships), and the oversupply of transport capacity for basic transport. According to Harrison and Van Hoek (2005) these factors in themselves contribute to the increasing internationalization of logistics: physical distance becomes less important, even for bulky products. However, the lead time dimension loses some of its relevance, from a transport point of view. No more a company has to

rely on a sole freight forwarder and book their overseas shipments months before the goods are even manufactured. Basic and express transport is these days available in variety never experienced before, and the fierce competition in the business ensures the supply of cost-effective transport services.

Because customer demand can these days be very volatile and unpredictable, the *accuracy* (the right quantity) of delivery can turn out to be a more demanding challenge than *speed* (the right time). Nowadays speed is available through different transport modes (container ship, air cargo, express, and courier, for example) at reasonable prices and even a relatively complex network structure can be applied in both distribution of the supplies and the actual goods manufactured. These changes have opened up new possibilities for the transportation of semi-finished goods and components even within relatively complicated supply chain structures.

In the context of our research, this development towards more random market conditions leads us to the choice of appropriate delivery strategy. In very volatile markets, control over international inventories by means of centralized inventories can be crucial. Overall delivery reliability ("on time in full") tends to increase significantly, much to the benefit of an organization's performance in terms of service requirements (Harrison & Van Hoek 2005, 102). In Table 5 three basic delivery strategies are described. Where they mainly differ is the level of centralization, overall inventory levels and the lead time to customers, in other words the time-to-market. The decision regarding the choice of appropriate strategy can be product line specific, because firms often have a wide range product range – varying in the means of predictability and inventory turnover.

The ability to balance peaks across market regions from a central inventory is also among the additional advantages an international paint manufacturer could receive through centralization. Taking the European market as an example, different levels of inventory centralization can be applied according to different dimensions – ranging from local inventories through international to the complete continent.

TABLE 5. Three different delivery strategies (Harrison & Van Hoek 2005, p. 105)

Delivery strategy	Description	Pros	Cons
A	Direct shipment of fast-moving predictable lines. Held locally, probably pre-configured	Short lead time to customer	Multiple inventory points leading to duplication of stocks
B	Inventory of medium velocity, less predictable demand lines held at generic level awaiting final configuration	Lower overall levels of inventory, consolidated shipments to distribution centers and concentrated handling	Longer lead time to customers
C	Slowest-moving lines, least predictable. Perhaps one shared global inventory or make to order	Lower overall inventory levels	Long lead time to customers

What makes it interesting for a European paint manufacturer is that centralized inventory management and focused factories enable different delivery strategies to be combined. Customer deliveries can be shipped in various shipment modes that each can be executed alone or alternatively used to complement each other. This is particularly relevant when thinking about the possibilities of implementing form postponement and late customization only with a limited product assortment specially selected for a pilot venture, for example. Thus the concept can concern only a specific part of the international distribution network, and possibly later expand within the network.

Figure 3-1 depicts how the choice of the appropriate delivery strategy positions itself in the field of theories previously discussed. In a global network the right selection for each market area can be decisively important, while big multinational companies can use multiple strategies alongside each other when their operations and business give a reason for that. The three different delivery strategies (listed in Table 5) can thus be applied as seen appropriate, depending on the sales and predictability of each product line. With consumer products, the globalization of business has close relations with today's more or less straightforward use of middlemen and business partners globally. Many international manufacturers thus constantly seek co-operation possibilities in regards to the export markets and their acclaimed consumer goods. For example, an opportunity to think globally arises when the main product relies more on the product image and its promotion and marketing and less on its manufacturing origins.

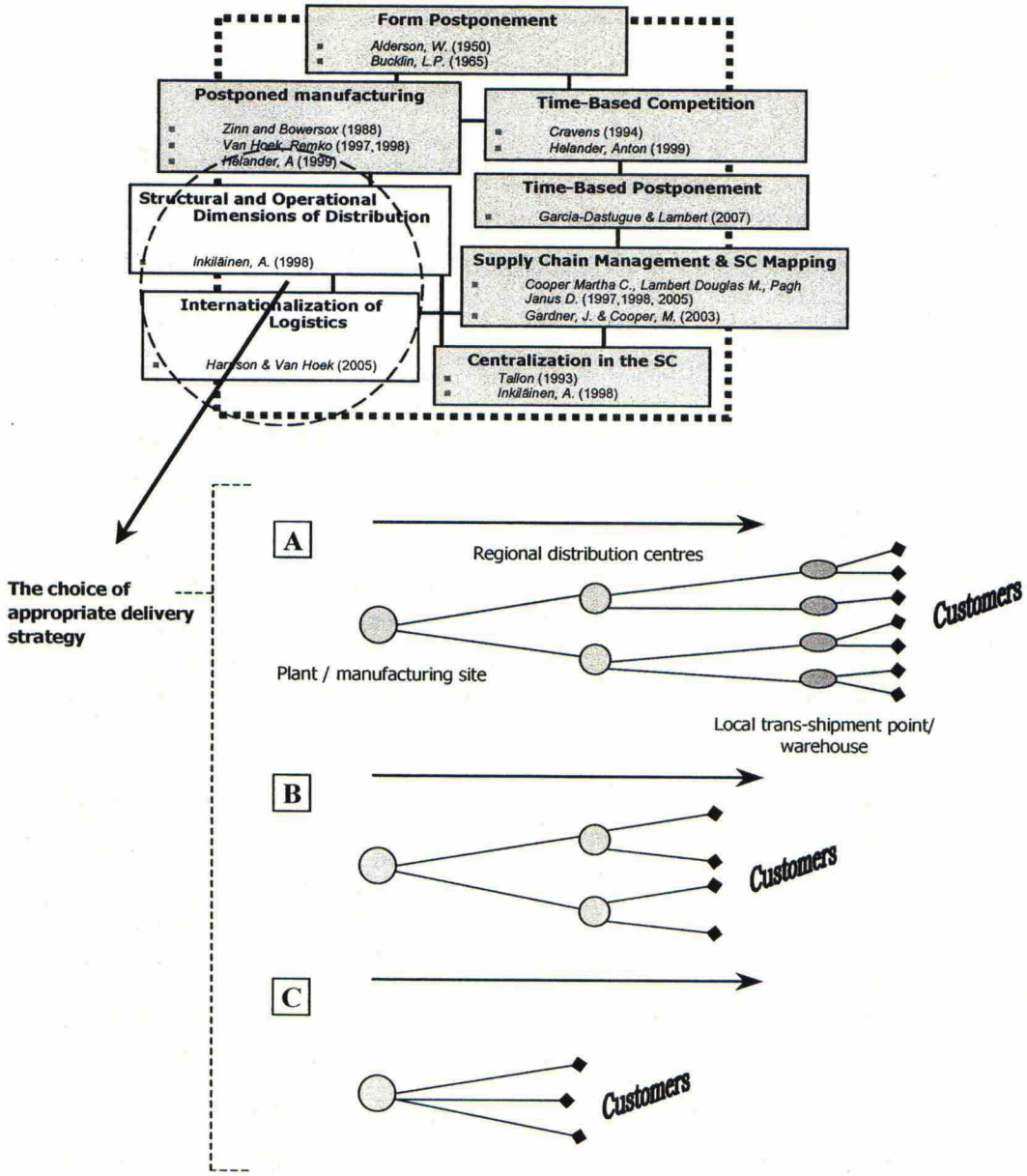


FIGURE 3-1 The choice between basic delivery strategies in a global network

The pharmaceutical industry provides us with a good example of this: many medicines and pharmaceutical products are manufactured by a single manufacturer (often corporations described as pharmaceutical giants) but are available on the market under various brands with different promotions. This is possible, thanks to different country specific marketing authorizations and bilateral agreements between pharmaceutical companies that allow marketing a single medical product with different brand names and altering packaging[7]. The key to success in many consumer products is often about quality, good image, cool design and labeling. This considered, it rarely makes a difference where the consumables are actually produced, or by whom.

[7] Interview with Johanna Hamberg, Head of Document MGT and Labeling, Orion Corporation

3.2. The Principles Behind Postponement Applications

Implementing postponement by changing the sequence of activities is a structural decision and requires capital investment. That is, the products, the processes, and/or the supply chain network structure require changes to implement postponement (Garcia-Dastugue & Lambert 2007, 59). With the change in the fundamentals of packaging principles, also the flexible labeling initiative requires investments; the re-design of the basic paint can, additional labeling and packing equipment installed closer to the markets, new structure for the inventories within the supply chain, etc. When redesigning the product and processes in each case the use of the following principles (Lee & Tang 1997) is recommended:

- *Standardization*: using common components or processes so they can be used in multiple finished products.
- *Modular design*: decomposing the product into sub-modules and delaying assembly of product-specific modules.
- *Process restructuring*: re-sequencing some manufacturing steps to delay the assembly of the product-specific components.

When we think of the labeling process of paint cans, there are many components that are standardized and further widely used in production. Good examples of this could be the 3 liters paint can, the cover particularly designed for it or the cap attached on top of each paint can to close the hole through which the paint has been tinted. These are all elements that are widely used in supply chains within the paint industry, both on domestic and international markets. Another such standard more associated with labeling could be the open space in the label layout left for additional language stickers to be attached later on. Also flexible labeling calls for standardization and universal product designs: only this way the designing and engineering of the final manufacturing activities become feasible and somewhat reasonable.

In the case of paint product containers there are many variables in the techniques how the desired information is printed or attached on the side of the products so that it's first of all visible, cost-effective, somehow rational, and possible to carry out. What brings flexibility to it is the decomposing of the label into numerous sub-components and fields of information. The previously mentioned idea of bringing the label down to two explicit components represents a good example of modular label design. Here a 'base label' where all the information required for

shipping would be printed and a 'finishing label' where all the market-specific information in desired language would be printed would combine for a finished label having a customized outlook in each case, especially fit for the targeted retailers and customers.

By postponing some of the labeling processes closer to markets, and thus moving the location of the point of product differentiation, it is possible to create a number of different product-variants out of a single "universally" labeled product item. Until this point in the supply chain it is favorable to minimize the number of product variants. The Finnish mobile phone manufacturer Nokia operates with the same figure in its logistics processes and knows it as the "variants at order penetration point"(VOPP) figure.[8] Explicitly postponing all the possible order-dependent customization to this point is what makes most of whatever postponement strategy is chosen, and is also one of the applied principles behind Nokia's success story.

The phase of manufacturing that this thesis pays attention to is product labeling. As one of the differentiating stages of paint production, labeling is closely related with many of the factors affecting the viability of postponement. As previously discussed in section 2.5.2, many characteristics of a firm's business environment can favor the use of postponement. In the following Figure 3-2 we recapitulate how the possibility to successfully apply postponement on a differentiating stage of production depends on the above mentioned factors (with positive effect), and relates with the main principles behind all postponement applications.

[8] Interview with Jari Saarenpää, Head of DSN Management at Nokia Corporation

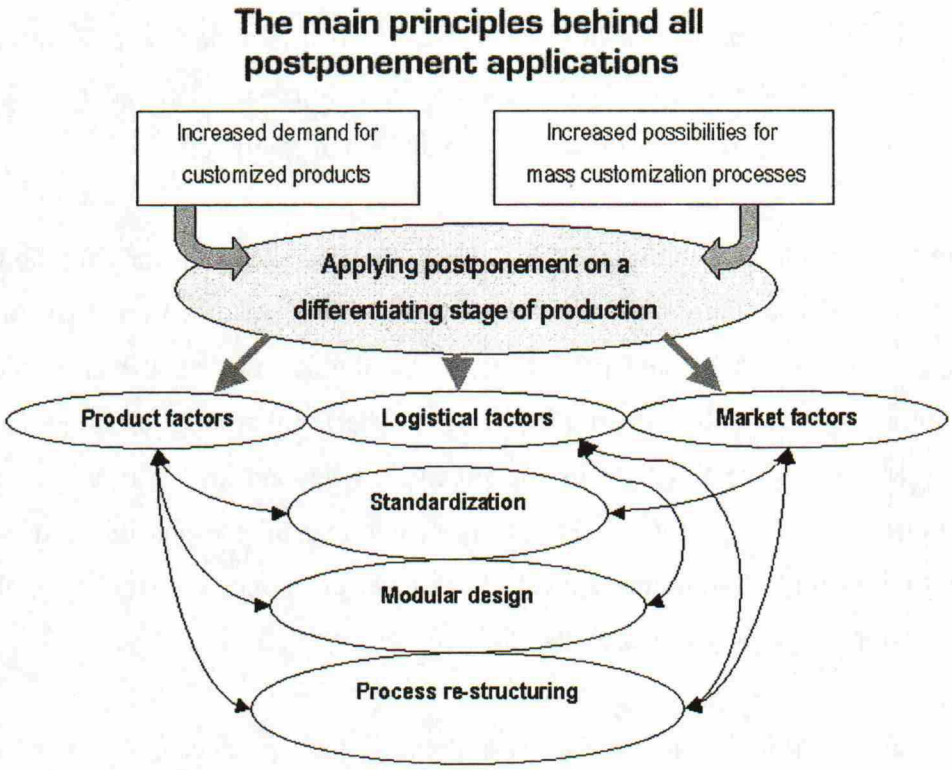


FIGURE 3-2 The three main principles behind all postponement applications and the factors affecting the viability of postponement

With our research objectives in mind, the latter part of this study concentrates on the re-structuring possibilities of labeling activities within the supply chain of a paint manufacturer. Practically this means that we need to analyze what is needed for labeling in theory and in practice, if the goal is to at least partly re-sequence and delay the product differentiating stage of the labeling process. What will also be noteworthy, is how the operations moved downwards in the distribution channel will change the nature of many warehouse facilities, which have so far acted merely as bulk-breaking distribution centers for their appointed markets. These regional distribution centers will also now have a more important role in the company's logistics strategy.

To make the most of the possibilities this kind of process re-structuring could offer in the case of consumer goods like paints and lacquers a database for information sharing is a must. This can be even more emphasized with a field of business in question where the label texts and desired contents are constantly changing. Moreover, the increasing internationalization requires this database for all the commercial print material to be user-friendly, up and online around the clock and thus always available for each regional organization with access rights. Only this way all the relevant stakeholders (chemists, product managers, sales organizations) could simultaneously use, support and update it, if necessary.

3.3. The Integrated Labeling Postponement Framework

A close look at the research dealing with manufacturing postponement reveals that is similar to what Alderson (1950) originally described as postponement by changing the sequence of activities. Much later, in 1988 Zinn and Bowersox performed a numerical analysis using simulated data that involved four specific cases of postponement by changing the sequence of activities: labeling, packaging, assembly, and manufacturing. The descriptions of these four specific cases of postponement include shifting some manufacturing activities from the plant to warehouses. In one of them the manufacturing activity was specifically labeling, and in this case it was moved out of the plant and replicated at each DC. In this example of Zinn and Bowersox (1988), each warehouse became a small manufacturing plant. In our integrated framework for labeling postponement, presented later on in this section, we concentrate on situations where labeling activities are delayed to be performed later in different types of warehouses of the expanding distribution network.

Postponement by changing the sequence of activities might result in performing activities later in time, closer to when the end customer places the order. In which case, postponement by changing the sequence of activities also involves time-based postponement. However, we base our framework on the concept of interorganizational time-based postponement, developed by Garcia-Dastugue and Lambert in 2007. As earlier discussed it takes supply-chain-wide approach into postponement, and thus takes the thinking to a multi-firm setting. For a manufacturer this might best make sense in a situation where some of the labeling activities are shifted to independent importers, who with proper incentives may then finalize the product labeling. Therefore, it is important to recognize that there is a common goal for the implementation of postponement: to improve the performance of the SC as a whole.

Our framework, depicted in the following Figure 3-3, takes time-based postponement in to consideration in the sense of information availability. More precisely, the manufacturer should utilize the additional information received during the delay as well as possible. To set a practical example the information about sales, open orders, and customer specifications from different markets can be processed and utilized before the final labeling is executed. This availability of additional information is also listed as one of the main prerequisites for the implementation of labeling postponement.

Also the previously presented principles, used every time when any type of form postponement is applied, are included in the framework (see below), and are to be considered carefully before putting any of the previously discussed postponement theory into practice.

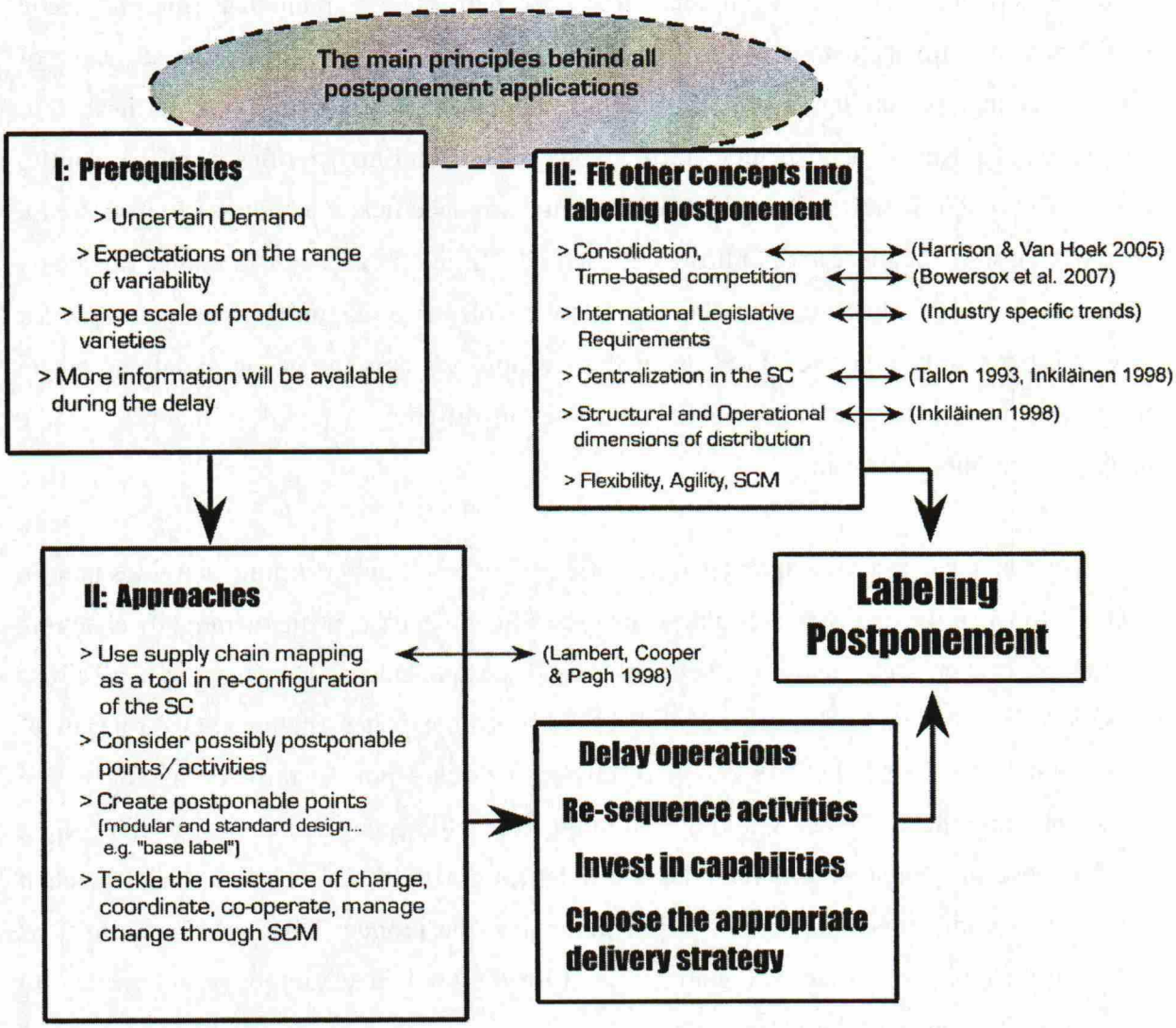


FIGURE 3-3 Integrated framework for labeling postponement application

Re-structuring and implementation processes often bring forward numerous managerial challenges. Besides requiring the attention of the management, the implementation of a manufacturing postponement application also tends to take time. No organizational change of this level ever happens in a week, or a month to be honest. Often only the rollout phase of a pilot program can take several months to put into action. With time on their hands, managers should thoroughly consider the implementation process being discussed each time and avoid making any hasty decisions. The framework presented above should lay the managers the groundwork for the

systematical thinking process and the successful implementation of labeling postponement applications. Even though it doesn't directly guide its user with the actual execution of the required change process, it at least provides the user with a comprehensive set of ideas that should be given a thought while planning the actual implementation. In the following sections we discuss the framework in detail and go through the process step by step.

3.3.1. Prerequisites for labeling postponement - (part I)

Before a company should consider postponement applications to be used in their manufacturing processes a thorough analysis of the current business model and the business environment is recommended. It's also necessary to identify and fully understand the marketplace requirements. This is because there are certain conditions and situations where the implementation of postponement is more likely to succeed (Yang et al., 2004).

First of all, it is essential to know how the demand patterns are structured and have a solid perception on the uncertainty of the demand, and how it varies throughout the business field. The strength of postponement lies in its capacity of coping with those uncertainties inherent in dynamic and changing markets, which companies may have to accommodate in their business strategies. There should also be some expectations on the range of the variability, and the managers should somewhat know what kind of development is anticipated for the demand in the near future for each regional market. Only this way the stock levels can be adjusted rationally and even unexpected and surprising demand from different market areas can, at least to some extent, be prepared for.

In general, short-term forecasts for an item are more accurate than long-term ones. This principle is true also for global products tailored to local markets. For international manufacturers it is increasingly difficult to forecast demand for every product variation, which results from technical requirements and customer preferences, in every sales location. Yet, once companies choose to target certain markets, the extent of product variability is clear and forecasting is easier at the generic level than at the level of finished item. Thus HP has to forecast only the total demand of printers, Volvo must estimate the future sales of a car model, and Tikkurila's first task is to forecast the aggregate demand of each decorative paint product.

Also for postponement to add value for the company there has to be a relatively large variety of different products offered to the customers. This, on the other hand, means that there is a list of product features and characteristics that make the product different from each other. Only by explicitly postponing the point of differentiation, and minimizing the number of variants at the order penetration point companies can truly generate savings through postponed manufacturing. And still it can only benefit the company on the condition that more information will be available during the delay. Otherwise there is no sense in delaying any of the production related activities. This important principle is behind every postponement application, and is also apparent in the previous illustration of our integrated framework for labeling postponement application (see Figure 3-3).

3.3.2. Approaching the change - (part II)

When approaching the implementation stage of a postponement application there are certain issues companies should pay special attention to. Considering the application of the theory, there should be postponable points to begin with. What helps in identifying those points and other crucial structures in their operations internationally is supply chain mapping. Lambert, Cooper and Pagh (1998) suggest managers to use their approach to map their supply chains for analysis and possible redesign. This approach is based on the idea of first mapping individual processes and then superimposing them on one supply chain map. The map is then a tool that helps to visualize the supply chain as it is and as it can be. This is why we strongly believe that using supply chain mapping as a tool in the re-configuring phase will guide managers in the effort to develop and manage their supply chain.

Secondly, to successfully utilize postponement, companies should start with carefully considering the possibly postponable activities in their operations. Only when explicit points can be identified, it is possible to move on with the implementation and further restructure the activities. If the product currently manufactures with no feasible activities for postponement, such points can alternatively be created, for example through standardization and modular design. This usually involves considerable changes and new innovations in product design. And what also influences product architecture/design are the company's pre-existing organization structures and capabilities.

After the postponable activities have been identified it becomes of utmost importance that the change needed and identified by the managers is systematically managed forward. Without appropriately tackling the resistance of change and with lack of sufficient cooperation companies commonly face the invisible wall of resistance of change and eventually come up short in their quest for increased efficiency. No organizational change of this magnitude can be carried out successfully without the management's sincere support and well-organized change management. This is why, when managing a considerable change such as the implementation of postponement, the vital role of the management can never be stressed too much.

3.3.3. Fitting other concepts into labeling postponement - (part III)

In the process of change many company-oriented issues have to be taken into consideration. For a company importing products internationally across many countries and market areas, logistical rationality comes into play. Shipping consolidation and time-based competition drive companies towards efficiency and change the nature of customer deliveries. Also other things influence the distribution structure suitable for the strived strategy. Centralized operations along the SC on their behalf support the application of postponed manufacturing and thus the improvement of the overall performance of the distribution channel. Additionally, also the other structural dimension of distribution; the number of echelons needs to be examined in order to find the optimal distribution structure for the application. Only by including all the dimensions, it is possible to actually succeed in increasing the flexibility and agility of the whole supply chain

With a special industry like paints and lacquers in question, one of the most challenging characteristics of the business are the requirements set by the legislative direction. The production of chemical products is restricted and controlled in many ways, and by no chance is their shipping and transportation left unregulated. This peculiarity brings its own spice to the problem-solving situation and definitely makes the logistical process even more complicated. Even though the European Union has commonly standardized the legislation in most of Europe, there are many market locations that require some individual attention in regards to their legislative requirements. The emphasized significance of these regulations led us to include them in our framework otherwise industry-neutral and applicable also among other manufacturers.

3.4. Managing the Change Through SCM

Companies worldwide have increasingly identified the need for the integration of business operations in the supply chain that goes beyond logistics. In this research we use the definition of supply chain management developed by members of The International Center for Competitive Excellence in 1994 (Cooper et al. 1997): Supply chain management (SCM) is the integration of business processes from end user through original suppliers that provides products, services and information that add value for customers. Accordingly, postponed product labeling is all about information adding value for customers. Thus, market-specific labels added to the products along the supply chain, near the point-of –sale can be seen as exemplary SCM initiative.

Our belief is that only a well-managed postponement application can, at least to some extent, contribute to the strategic capabilities of the global organization by contributing to global efficiency. This is supported by Van Hoek (1998, 191), who states "it appears that postponement is more than an operating principle and has to be seen in relation to the strategic capabilities".

After the right approach to the application of postponement is found, it is time for the actual organizational change to take place. This part of the process often turns out to be the most distressing and the most challenging one. It is said that managing a large-scale SCM initiative such as postponement application is where the capabilities of the managers are truly measured and the competence of the whole SC is trialed in real life. And only SCM provides the required tools for managing the dynamic process of change.

For the change to take place also additional investments in capabilities are often required. Logically, the same machinery localized at the main production facilities cannot take care of the postponed steps of the manufacturing process. In the case of a labeling postponement application, the additional labeling lines and the label printing machinery required downstream in the channel represent a good example of this. Later on in Chapter 5's cost calculations the installation costs of the added capabilities are counted as a part of the total investment. According to Twede et al. (2000), postponement applications have generally grown because international firms increasingly customize their products for local markets. To support this, recent literature included a number of articles drawing insights from samples of European companies. In the next Chapter we will have a closer look at one of them, and further analyze the situation at the case company Tikkurila Oy.

4. Case Tikkurila Oy

The aim of this chapter is to introduce the research approach and describe how the empirical part of the study was conducted. The preceding chapter provided an overview of methodologies previously exploited in the postponement literature, with the intention to match an appropriate existing research approach to this particular study. In this chapter, we present the research approach utilized in this study, followed by the description of the company where the case study was conducted. After this we explore how the data used was collected and analyzed, before concluding the chapter with a discussion on the labeling processes and the major challenges related with international product labeling.

It is commonly becoming accepted that "why" and "how" research questions can be approached effectively using a case study method (Ellram, 1996). Moreover, a case study method enables the researcher to develop a better insight into a complex and somewhat unexplored phenomenon, which is being implemented only recently and is expected to increase rapidly in use. Within the paint industry, labeling postponement can be seen having such a status, and only limited research on the topic and few managerial implications can be found. When describing the case company, we explain how things are currently done, and also try to find the reasons behind the existing operational models.

4.1. Scope of the Empirical Study

The concept of postponement can be applied to a minor or a major share of the operations in the supply chain. In case of Tikkurila we concentrate on its applications regarding product labeling, and thus, postponement goes only as far as packaging before final distribution. But as the brand is desired to be global and the formulation of the products usually common to all markets, it is justified to discuss the products peripherals as our priority. The main purpose of the empirical study is to analyze the labeling processes and the potential of different postponement strategies in the continuously growing export market. For this we use the earlier presented theoretical framework, called "The Integrated Labeling Postponement Framework". The framework and the study are categorized as normative, because the purpose of the study is to find an answer to a specific managerial problem.

In order to define a proper postponement strategy for Tikkurila, the assessment of the level of environmental uncertainty, together with the costs and benefits of postponement, must be made explicit and analyzed. This study aims to offer an empirical basis on which the company can base tomorrow's strategy decisions in line with its resources and the current highly uncertain business environment.[9]

Putting something off until the last possible minute isn't usually thought of as an effective business practice. However, for many manufacturers this strategy has certainly paid off, and today many industry-leading companies put the final touches on products and packaging just before they roll out the dock doors for delivery. Next we describe a manufacturing company taking its first steps into postponement of product labeling applications.

4.2. Tikkurila Corporation

The case study was conducted within a paint manufacturer, Tikkurila Oy. Established in 1862, Tikkurila develops, markets and produces paints and coatings for the general public, professional painters and industrial users. As a traditional paint manufacturer the company has its roots deep in the Finnish chemical industry. Through continuous expansion Tikkurila has become a strong regional player in Europe, with a leading position in Northern and Eastern Europe[10].

The initiative for the research came from the company's side. Within the last ten years Tikkurila has expanded its operations remarkably and now focuses extensively on export and international markets. By export we imply to the international sales excluding the sales of abroad subsidiaries with local production. Thus, we explicitly focus on the imports sold on each market under Tikkurila's international main brand. Today there are production units in seven European countries and sales units in six more countries. Products for private consumers and industrial use are sold to some 30 countries, mostly in the Middle- and Eastern European markets. As for postponement strategies, Tikkurila already had experience with manufacturing postponement (paint tinting/coloring), so the company provided a unique opportunity to study the relevant operational characteristics and drivers.

---

[9] Information on the case company has been collected by interviews during fall-winter 2007

[10] Tikkurila Group's internet pages, www.tikkurila.com, Investor Information

As a part of the international chemical industry group Kemira, Tikkurila is responsible for Kemira's paints and coatings business. In 2007 (2006 figure), Tikkurila (Kemira Coatings) had a staff of 3,800 (3,500) and net sales totalled EUR 625 (563) million. With positive market development and increasing sales net sales for January-September 2007 went up 12% and totalled EUR 506,8 million (EUR 453,5 million in the same period in 2006, respectively).[11] Also investments have been going up from 2005 onwards, respectively accounting for 18, 47, and 49 million euros in 2007.

When it comes to industrial postponement applications in general, Tikkurila can be regarded as one of the pioneers in the chemical industry. The company was actually one of the first paint manufacturers in the world to implement postponed paint tinting, which now is more like an industry standard. These days tinting systems are widely used and offer the paint user a wide selection of available colours, of the order of several thousand, from a selection of standard white and transparent paints (bases) and pigment concentrates (tinters). The paints maybe mixed in-store at the point of sale (POS) and sophisticated equipment is required to dispense accurately, the volume of tinter required to produce an accurate colour match. By postponing the differentiation point of color paints in such a way Tikkurila gained markets and an image of an innovative company, especially in Europe. Strong R&D and highly automated production technology ensure first-rate quality products and services.

The corporate headquarters is located in Vantaa, Finland, where the traditional paint manufacturer has a large home site with many production plants, administrative functions and supporting facilities. Most of the actual manufacturing is highly automated and controlled by process computers. The principle of mass customization is easy to see in the manufacturing process at the Monicolor plant, opened in 1975. The majority of the factory's production leaves the site as either white or transparent base paints and receive their final colour only at the retail outlet. The site also includes units devoted to R&D work that continuously test and develop the products set up for production and sale.

Tikkurila's product portfolio includes a wide variety of interior, exterior and floor paints, as well as different kinds of lacquers and primers. Since Tikkurila Coatings (industrial coatings) and Tikkurila Paints (decorative paints) merged the first of January this year (2008), the new common

[11] Tikkurila Group's internet pages, www.tikkurila.com, Investor Information

parent company Tikkurila Oy now holds an even larger selection of end products and active sales items under its name.

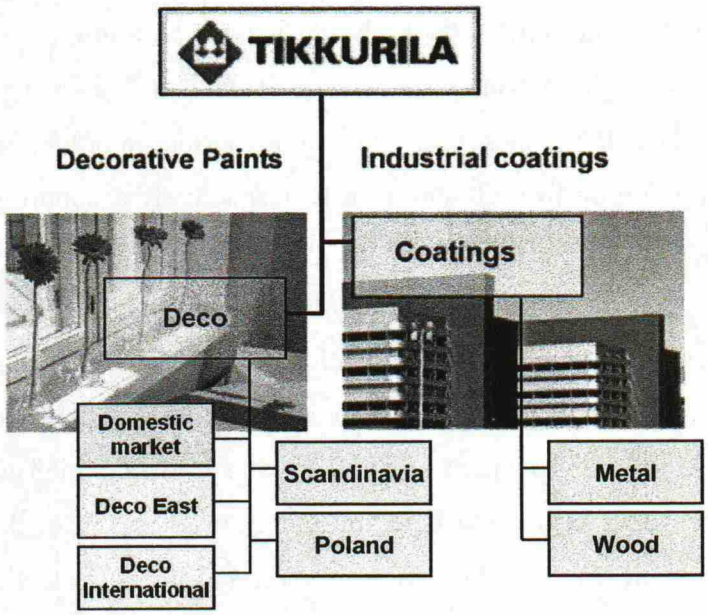


FIGURE 4-1 The two main categories of Tikkurila's product portfolio

The picture above illustrates how the group's products can be divided into two main categories based on the end-user criteria. Tikkurila Coatings targets the industrial users and Tikkurila Paints concentrates on consumer paints. The sales for decorative paints are further separated into individual sales units representing Tikkurila on their respective markets. Domestic market is taken care of as one separate entity. Deco East is assigned to serve Russia, the Baltic countries, Ukraine, and most of the other CIS countries, while Deco International represents and sells these products practically in the rest of the world, but concentrates on the markets in Southeastern and Central Europe, as well as China. Our spotlight and the focus of this study will later be on Deco International and one of its major product families offered to millions of potential international customers in selected countries.

4.2.1. Company's threefold brand strategy

Currently, decorative paints are available in more than 30 countries and they are distributed through a network with over 5000 retail outlets[12]. In decorative paints, the company has many leading local brands: Tikkurila in Finland, Russia and Poland, Teks in Russia, Alcro and Beckers in Sweden and Vivacolor in the Baltic countries. Other decorative brands include Polifarb Debica

[12] Interviews with Tikkurila staff

in Poland, Finncolor in Russia, Kolorit in Ukraine and Pigrol in Germany. In industrial coatings, Tikkurila Coatings is a well-known brand. The newest industrial coatings brands include Gamma and Ohtek in Russia. Overall, the group's brand strategy is plain and relatively simple. The two premium brands: Tikkurila and Tikkurila Coatings are sold internationally and often represent the high-end, high-quality, premium-price end of the paint products available on the market. To support the sales of these top brands the group has a number of cheaper regional and local brands, often produced, marketed and sold only locally or regionally, like Vivacolor in the Baltic States. In many market areas the local brands play a key role in supporting Tikkurila's whole product assortment and price category available at each region. Figure 4-2 sums up the group's threefold brand strategy that builds up on the idea of competitive mixture of brands positioned differently on the price range:

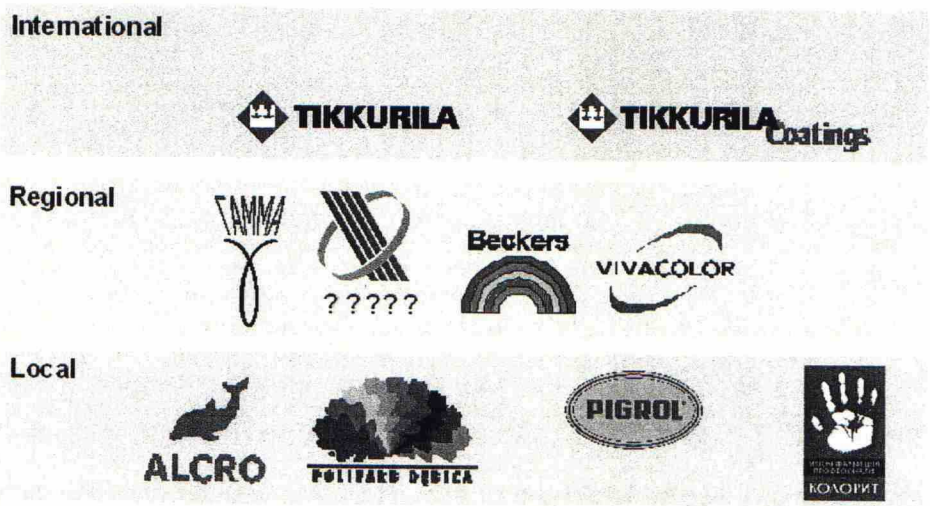


FIGURE 4-2 Tikkurila's international, regional, and local brands on the markets

Just recently, the first Brand Builder of the Year recognition was received by Tikkurila Oy, in connection with the Annual Meeting of the Finnish Association of Advertisers on March 27th 2008.

4.2.2. Expansion in the East (2002 – today)

Tikkurila has exported its products to the Russian markets for many decades already and the products supplied by Tikkurila and its subsidiaries are available in over 100 cities in Russia and other CIS countries. Tikkurila is generally well known, currently the best-known western paint brand in Russia, especially among the people working in the construction business. On top of imported goods, the company has also local production and nowadays operates all in all six paint

factories around Russia. In August 2007 the company announced, in line with its strategy, to strengthen its position in Russian markets even more. In Russia and East Europe especially the strategy is based on selected product categories – decorative paints and selected industrial coatings segments – and on growth, both organically and by acquisition.

Through mergers and acquisitions the company has expanded its production operations and now has productions facilities also in Poland, Russia, Estonia, Latvia and Ukraine. Tikkurila has just recently invested also in Hungary, where it expands its warehousing facilities into a new distribution center. This centrally located European distribution center will be opened in the fall 2008 to serve Central Eastern Europe, the Balkan region and the nearby-markets. Market expansions are expected throughout this region and export to countries like Romania, Greece and Turkey is expected to blossom.

Through recent mergers and active looking for new opening markets for Tikkurila's paint products, the company's export has grown significantly. In the next two years the company is expecting to have sales to nearly 40 countries.[13] The strongest growth in the near future is expected in Southeastern and Eastern Europe, where paint markets are expanding to keep pace with the rising standard of living. To cope with the increasing demand and growing sales the company has decided on a EUR 20 million investment in a logistics- /customer service center in Mytish, near Moscow. This center for logistics and customer service will enhance the level of service in the rapidly growing Moscow region, and is planned to open in the summer 2008. Besides supporting the distribution in the Russian market, the new logistics center will also include exclusive facilities for customer training, which plays essential part Tikkurila's sales and marketing.

4.3. Competitive Stance

Increasingly, companies competing in international markets have to be competitive on multiple dimensions. A dilemma is that they have to be efficient on a global level, responsive on a local level, and develop knowledge on a worldwide basis (Van Hoek 1998). This is the situation also for Tikkurila. While the company can achieve high levels of efficiency through centralization and vertical integration of operations on a global scale, to preserve its competitiveness, a certain

[13] Interviews with company staff.

amount of local responsiveness to customer wishes and the local market environment has to be assured.

The markets where Tikkurila competes are at many countries very challenging. Extensive support from the marketing is essential when strategy for each market is set. When the targeted market segments have been selected the next step is to identify how the focal firm is going to win orders in each. In other words, to define *differential advantage* that distinguishes Tikkurila's offerings from those of their competitors. In logistics terms, the important issues here are the *order winning criteria* (OWC), and *qualifying criteria* (CQ) for the target segments (Harrison & van Hoek 2005). For example, in the Ukrainian market it can be decisive to have certain information in the labels in Ukrainian. If the competitors are offering all the product information printed on the labels in the customers' own language, and Tikkurila only offers a product with Russian texts, the OWC here can turn out to be the label texts in the official local language. Appearance of the product packages can on the other hand be a CQ when a consumer is considering which of the premium paint product brands to go with.

4.4. Product-Labeling Dilemma

With expanding product variety for export, the problem has been the huge amounts of sales items with country-specific labels. Entering new markets and language zones with the same products and packages (with limited printing space) has resulted in skyrocketing of the sales items. In some can sizes it's only possible to fit four different languages in one label. This has been a deteriorating problem in the company for years already, and it generally concerns both industrial (Tikkurila Coatings) and private (Tikkurila Paints) customers. All this existing variety has lead to a situation where some of the sales items that have sold less than originally anticipated are practically piling up in stocks, while other sales item are stocking out every now and then.

Within the last five years the variety within Tikkurila's product range has exploded mostly due to market-entries and expanding demand in the Eastern Europe. This growth has escalated the amount of different end-market languages, and made it more and more difficult to label the varying-size sales items that are put out to the market according to rules and regulations. In the sense that both the private consumer marketing and the industrial marketing have faced similar problems with the language versions included in the labels, the research problem turned out to be somewhat widespread, and the possible solution very likely to be useful, at least to some extent,

for the whole company. Each manager responsible for a market segment and a specially constructed product range practically expressed their interest in the possibilities of "flexible labeling" one at a time. Generally it seemed that very limited work had been done with issues related with delayed product differentiation that copes with product variety, but ideas of how labels could accommodate some flexible elements had been around for years. Also, between the middle management a somewhat strong common interest for these theories and strategies existed.

4.5. The Challenge of International Logistics and Location

International logistics is complex, and very different from localized logistics pipelines. Harrison and Van Hoek (2005) list the main differences that need to be taken into consideration when thinking about the risks in international logistics, and how can they be addressed. They see the following challenges: extended lead time of supply, extended and unreliable transit times, multiple consolidation and break points, and multiple freight modes and cost options. In Tikkurila, all these issues have to be given thought before choosing the appropriate delivery strategy for internationally implemented labeling postponement.

For a company targeting the Balkan region and the developing markets of Southeastern Europe the situation even more complicated. In many of the countries and societies that have only quite recently won their indecency the infrastructure is still developing in many ways. This makes evaluating the logistics costs and the future cost structure even more problematic[14], and the concreteness of this problem was experienced also in the midst of this research. For some quantitative perspective and later use of the company staff, the author developed a freight cost calculating model (see Appendix 3) applicable with the country-specific sales data available at each point in time. But with Tikkurila's Hungarian subsidiary unable to provide the needed price information, the comparison of two alternative distribution structures (further discussed in chapter 5) ultimately came up short and thus failed to provide us with a solid estimation of the transportation costs incorporated with a centralized distribution model. The reasons behind this setback, on the other hand are consistent with the described situation. In comparison to the Western Europe, the structures of road transportation and road haulage are much more scattered and fragmented, and the transportation service thus more unpredictable. According to Hokkila[15],

---

[14, 15] Interview with Tikkurila's transportation manager Antti Hokkila

even the bigger logistics players and well-known LSP's like Schenker or DHL have difficulties giving out prices for the routes covering the Balkan and Eastern Europe. This considered the logistics personnel should carefully consider the decisions concerning future operational locations and transportation routes to be used.

4.5.1. Level of internationalization

Tikkurila has truly engaged itself in global operations while expanding its operations abroad and focusing more and more on the export markets. The company has established a local presence in foreign nations and trading areas (Russia, Poland, Hungary, Czech Republic and Ukraine) and is investing considerably in its expansion ventures abroad. Also the managerial involvement has increased throughout the last few years, and these characteristics rank Tikkurila to the second level of internationalization on the three-stage scale of Bowersox et al. (2007, 17).

The logistics of internationalization involves four significant differences in comparison to national or even regional operations (Bowersox et al. 2007, 17). First, the *distance* of typical order-to-delivery operations is significantly longer in international as contrasted to domestic business. Second, to accommodate the laws and regulations of all governing bodies, the required *documentation* of business transactions is significantly more complex. As a company producing chemical compounds constituting of also hazardous and flammable contents Tikkurila is truly facing the challenges of increased documentation and partly sees the same pressure also with labeling related issues. Third, international logistics operations must be designed to deal with significant *diversity* in work practices and local operating environment. Fourth, accommodation of cultural variations in how consumers *demand* products and services is essential for successful logistical operations.

While logistics principles and the ideals of supply chain integration are essentially the same globally as they are domestically, the above characteristics make international operating environments more complex and costly. All this already concerns Tikkurila and will further escalate as it builds up its distribution channels in Russia, CIS and Europe. The resulting increased expenditure in logistics is justified in terms of potential market expansion and operating efficiencies. Still, risk exposure related to capitalizing on international supply chain management and its logistical components requires integrated operating strategies and tactics.

4.5.2. The evolution of distribution

As discussed earlier in chapter 2, Inkiläinen suggested that a distribution structure normally develops through five stages, from direct export towards VAL centers. Another trend commonly acknowledged was the shift towards a more customized or differentiated markets. With these characteristics of recent develop throughout the industries in our minds we next take a closer look at the distribution structure and examine the SC structure of the case company.

The current mode of exporting paint products in Europe resembles in many ways the *gateway* stage of Inkiläinen's five-step classification. In most of the countries where Tikkurila sells its products there is a local presence responsible for the importation, marketing and further distribution. And in many instances this actor having an active role in distribution is also the sole importer and partner of Tikkurila. Thus, goods commonly route to the markets through one point of entry, and are then distributed through the local retailer-network. Although the distribution structure has worked well and goods have been distributed this way for years already, a shift towards distribution centers can be seen as a logical step and is a topical question on the management level. The investments in new facilities build in Hungary and Russia (logistics centers) indicate the move to the EDC level on the five-stage evolution process, and with late customization applications under consideration, the VAL centers presenting themselves as the next step in the fore coming years.

4.6. Supply Chain Structure

In the paint industry, the main supply chain stages are production, transportation and warehousing. For Finnish producers, transportation consists of two modes of transportation, road haulage and sea transportation. Practically, the transportation often includes both sea and road freight before the final delivery to customer, either directly or through distribution centers or warehouses. Since the transportation is a multi-stage process products are often stocked at the transportation mode changeover points, for example, at terminals operated by the freight forwarding companies. Figure 4-3 depicts the general relations of Tikkurila's current SC. The distribution centers, usually breaking the bulk and further taking care of customer deliveries, are mostly owned and operated by the group. In only a few countries there is an independent operator responsible of importing Tikkurila's products. In some countries there is also a separate wholesaler organization between the company and its representative retailers.

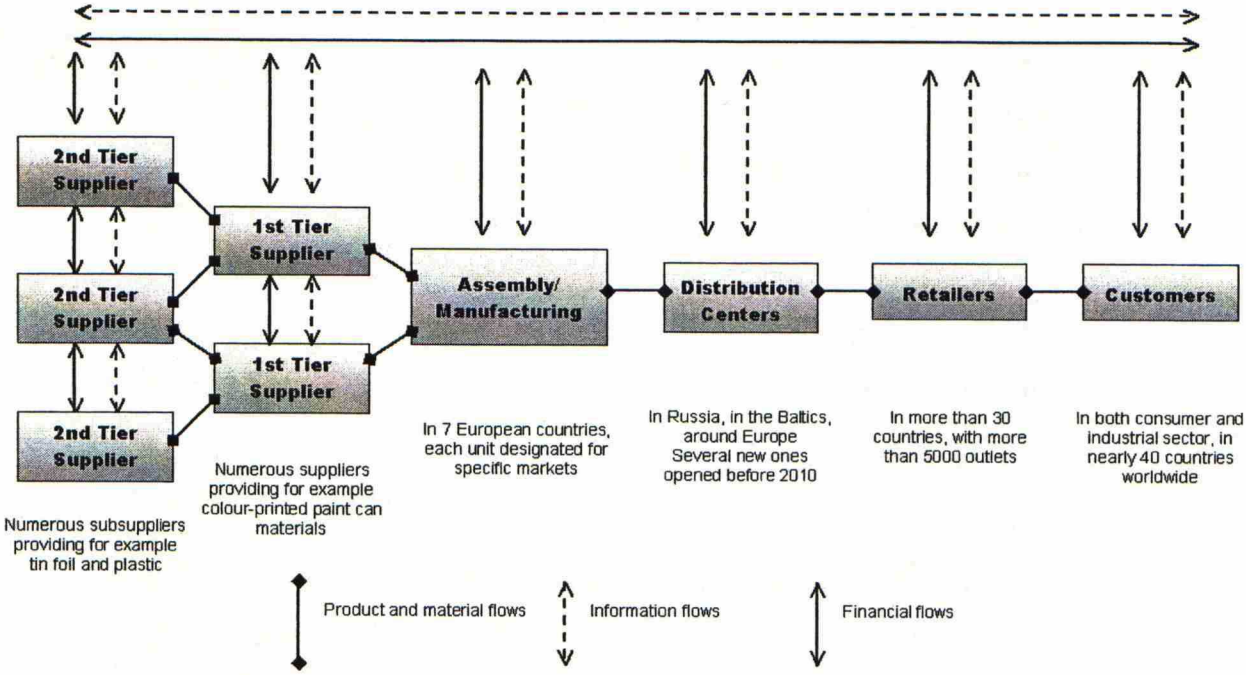


FIGURE 4-3 Tikkurila's operations and supply chain relations

Each stage of the order-delivery process can add value to the products through four forms that are time, place, form and possession. So far the only phase of form value adding has been production (factories), in which inputs such as raw material and labor are used. Only randomly have some products been modified later on after leaving the production facilities. In most if not all of these instances the case has been additional labeling of some kind, often manually done as agreed by the wholesaler or the retailer. Still, the company has faced the reluctance of the other parties to perform any additional labeling activities. Often the country organizations have been reluctant to manually add any labels because of its impracticality and the extra work involved. Still for example in the Baltic markets and Ukraine the organization responsible for the local distribution has agreed to co-operate in executing the extra labeling and many shipments have been manually labeled with extra stickers in the national warehouses[16].

Production involves the majority of investments in this capital-intensive industry, thereby emphasizing the role of the subsequent stages that are warehousing and transportation as functions creating the efficiency in the distribution chain. Fast production process isn't much of an asset for any producer if the shipments cannot be well executed and the competitiveness thus secured. Stocking along the supply chain always has a negative impact on the time component,

[16] Interview with Mila Käkelä, Sales Executive for Ukrainian markets.

since the capital tied in paint and coating products is not effectively used. Thus, Tikkurila among other paint producers aims to minimize stocks and the inventory value capitalized each moment. Naturally, international operations and the product characteristics don't allow a make-to-consumer order environment, and therefore buffering with inventories is often necessary and warehouses are operated in tens of locations within the dynamic international distribution network.

4.6.1. Mapping the current supply chain

As we previously found out in Chapter 2, there are numerous compelling reasons to map the supply chain. In Tikkurila's case it helps us to link the company's corporate strategy to their supply chain strategy. It is also needed to catalog and distribute key information for survival in a dynamic environment. When planning the future of the SC, the map can play a key role in alerting the planners to possible constraints in the system. This is very much appreciated when the company is actually working with possible significant supply chain modifications, as is the case with Tikkurila's European distribution network. Changing the mode of international distribution more towards a network structure relying on regional distribution centers and postponed manufacturing activities executed only just before the final transportation and customer delivery is a significant change in the system, and thus requires appropriate planning.

As mentioned earlier, the unit responsible for the European export markets for Tikkurila's decorative paints is called Deco International. Respectively, Deco East represents the group in Russia and other CIS countries. During the last ten years Tikkurila's consumer paints have seen steady growth both in Russia and the Eastern European markets. To support the growth and boost up the developing international sales Tikkurila Paints has entered various new markets and started numerous new partnerships, for example in the Balkan region. In many countries viable contacts for future co-operation are sought and possibilities for exports to many new market areas are being mapped. The previously described product-labeling dilemma is closely related with the increasing amount of market areas with a diverse set of languages in use. Russian markets are offered a similar product range than the domestic market, which of course is labeled in Russian and a few supporting languages. This is why the case study from this point on focuses on the Central and Southeastern region of Europe and excludes the distribution structure and labeling processes of products exported to the Russian markets. The following Figure 4-4 depicts how most of the EPR products are distributed to European customers as of today.

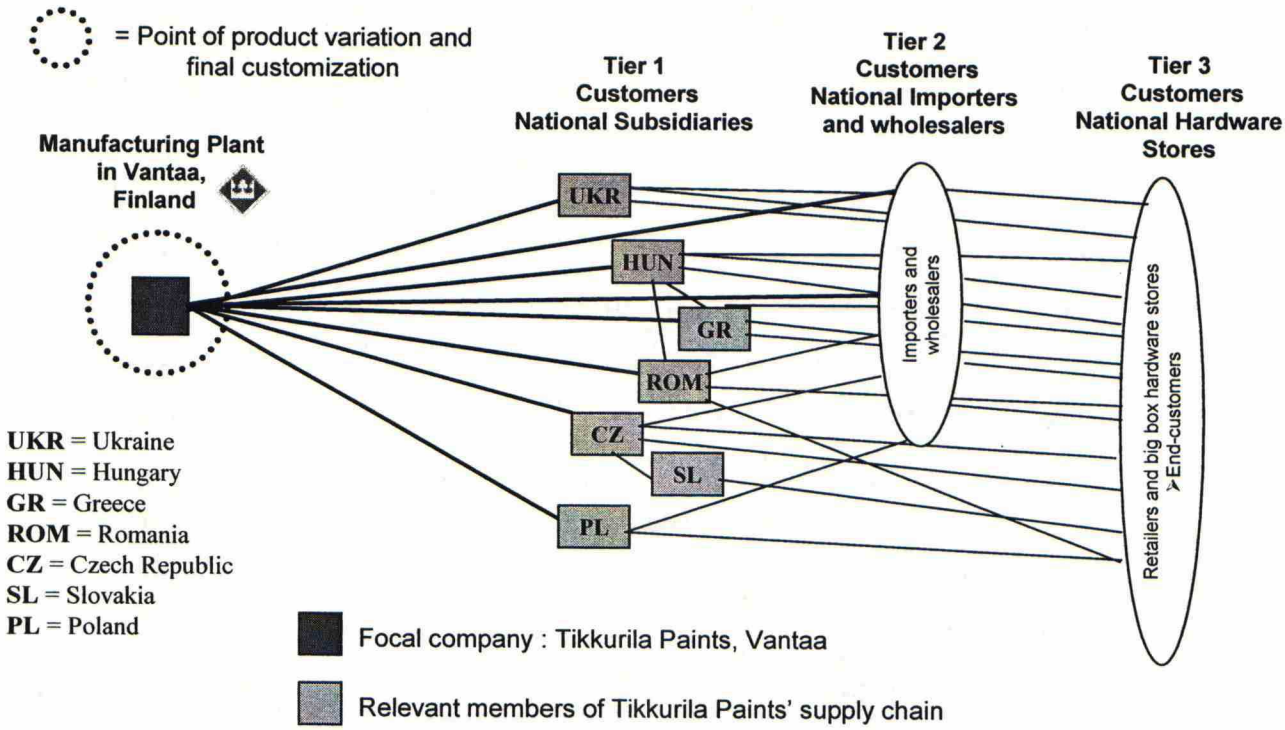


FIGURE 4-4 Current structure of Tikkurila Paints' distribution network in Central and Southeastern Europe

From the illustration it is easy to notice the significant role that the groups own national subsidiaries have in many countries, acting as a gateway to the markets. The network structure is a result of international expansion that has taken place in the last 10-15 years. For an outside person the structure of the distribution might appear to be somewhat cluttered, as there are often alternative routes for paint products to reach their target markets and end-customers. For example Romanian hardware stores often receive their orders from Tikkurila's subsidiary in Hungary, and large parts of the paints sold in Slovakia are first shipped to a warehouse in Czech Republic. All in all the structure of Tikkurila's expanding distribution network is rather complex, and to get a better picture of all Tikkurila's international operations, today's export trade and the central role of the Vantaa site located in Southern Finland, see appendix 2.

4.6.2. Production stage

Production, a continuous flow process, is controlled by manufacturing orders. The Finnish paint industry is not solely made-to-order production, because orders can also be issued either by customers or sales network for maintaining specific stock levels at market warehouses. One advantage of this ordering system creating relatively long order stocks is that the producers can plan their production earlier. The planning can be done in accordance with the pre-set production

programs of the production lines, which enable production sites to confirm delivery times to customers. Then again, the longer the order stock, the easier it is to optimize the utilization of production capacity.

For many of the paint products the period for sale is around five years. This fact creates peculiar marketing complexities that never come into question with everyday consumables like drinks and food. It also changes the fundamentals of the labeling process and adds more challenge to it. With the laws and regulations (such as VOC, REACH and the laws concerning trade outside of the EU) guiding the labeling of paint products continually changing and the marketable product-mix living on monthly or weekly basis, it becomes somewhat impossible to avoid product obsolescence deriving from out-of-date labeling. Generally, most of the supply still finds demand and production lots relatively rarely end up being demolished unsold. Still the write-offs in accounting deriving from obsolescence of products are thousand of euros each year. For the last two years the exact figures for the companies operating at Vantaa have been 57 (2006) and 28 (2007) thousand euros[17].

4.6.3. Labeling process

Before the products can be put onwards in the chain, even to another production facility, they have to contain certain information. The European legislation restricts the shipping of chemicals and chemical compounds in many ways, and it is understandably illegal to internationally ship anything in blank cans or containers. This makes it mandatory to arrange at least initial labeling subsequent to actual production and canning, before any transportation takes place. Practically, this leads to the labeling of all the paint products right at their designated production site wherever it locates. Another question is, what is the information that is rational to have on the products at this phase of the supply chain and what parts of it is reasonable to have in unchangeable form, and how this restricts the customization of the product later on in the SC. The central question of this thesis being, how more flexibility could be added to the labeling process, it is the first thing to clarify how certain things are currently done, and why?

Throughout the industry paints and lacquerers are commonly packed in either tin plate or plastic. The cans on the other vary greatly on their size, shape, capacity and mechanism that holds the

[17] Tikkurila's Accounting Department

cover closed. Also the printing technique that is used for labels varies: paper labels and paper-printed stickers are used alongside color-printed cans, often ordered from external suppliers. Both plastic and tin plate cans are in use and can carry color-printed graphics and labeling.

For the supply of color-printed cans Tikkurila currently uses three suppliers; these are Crown-Pakkaus, Emballator and MetalPak. Out of these three suppliers Crown-Pakkaus Oy ("crown-packing") is by volume the most significant for Tikkurila. This is because the vast majority of product cans using color-printed labels are bought from C-P. Although the looks of the labels printed this way is often superior when compared to sticker labels, the technique has its weaknesses. The main problem with color-printed cans lies in their lack of flexibility. First of all, the minimum order quantity for a specified color-printed can is around 4000 pcs., when many sales items can have a much lower for the total annual demand for several reasons[18]. Though the minimum order quantity varies with different suppliers, the feasible order lots are always hundreds of pieces. Secondly, the cans must be pre-ordered weeks before their respective production lot hits the filling lines and all the suppliers have their lead times for each type of color-printed cans. And in top of all this, the labels currently used have zero flexibility once the color-printed cans for a specific production lot have been ordered. This considered problems always occur when some information in the label (concerning legislative or promotional information) becomes obsolete or needs to be changed for some other reason. Often in these situations considerable amounts of pre-ordered cans ready for filling have to be disposed and wrote off just because of the lack of something or the wrong information they carry.

4.7. Labeling Challenges

With limited visible space, and the cover of the cans often reserved for piercing and tinting later on in the process, the sides of the cans practically represent the only choice for label space and thus printed information. Such information can consist of images, logos, instructions, contents, warnings, date codes, pictograms and marketing messages. This information then, printed or glued to the sides of the paint product is where all the biggest challenges of paint product labeling culminate in.

---

[18] For example opening market areas with business opportunities only emerging, or sales items (e.g. primers) that support the sales of other important volume products.

With the uniting Europe and continuous changes in legislation there are many challenges related with product labeling in general. The situation is especially demanding for industries dealing with hazardous chemicals and compounds, and on the other hand, selling their products directly to common consumers. European paint industry is one good example, where all the players within the industry are now facing similar challenges. While the business and sales become more and more international, it becomes harder and harder to match all the requirements the legislation, customers and marketing set on a paint product label. It has to simultaneously deliver the important marketing message, include instructions and pictograms guiding the use of the product, and carry various industry-wide standardized warnings related with its contents (VOC, Harmful, Dangerous for the environment).

4.7.1. Legislative pressure

For decades already the paint industry has been confronting several health related issues calling for changes and improvements in the products themselves, and their labeling. In the 1980's there was an industry-wide campaign to reduce the industry's contribution to volatile organic compounds (VOC) in the atmosphere. This was followed by health risks related with exposure to commonly used paint solvents. This made the companies to evaluate the level of solvents in their latex emulsion products, and put importance to labeling and its warnings as a crucial part of education. For years following this, the industry had to work to educate both commercial users and retail consumers about proper use of solvents.

In the United States and Canada the issues regarding paint labeling have generally been under active discussion. Debate concerning small adjustments to the regulations and non-disclosure of lead hazards contained in old consumer paints has triggered many opinions and contributed several articles. According to Warren (2003, 78) for several years now the challenge has been to create a system for labeling consumer products that would satisfy the labeling requirements not only in Canada and the USA, but also in most other parts of the world. Later on in 2003 this was achieved and what was called "Globally Harmonized System of Classification and Labeling of Chemicals (GHS)" was published. This first edition of the GHS was intended to serve as the initial basis for the global implementation of the system. Since then the Committee of Experts has revised it and adopted further amendments to it. According to the UNECE web-page (9.11.2007) the current, second revised edition of the GHS was published in July 2007, and full

implementation of this global initiative is expected by 2008. Also Tikkurila will be affected when this globally harmonized system comes into effect.

In Tikkurila there are four directions that have regulative power over the label texts and information. First of all the product manager for each sales item is responsible for the descriptions of the product and to some extent for the outlook of the actual labels. Another direction that has control over the printed texts are the chemists working for Tikkurila. They are responsible for the ingredients printed in each product label and their correctness. Third party that has power over the label texts is the product safety department, which checks that all the appropriate caution and warning signs find their way to the final label. Fourth are the people responsible for exports and the translators in their respective countries, with the responsibility for fitting translations and correct language terms.

4.7.2. Informative labeling

The competition for space on the paint label, if it is to fulfill all of its roles, is very great and it is aggravated by the growing need for multilingual labels and the need to minimize packaging, production runs and stock-holding costs in international trading. The problem culminates with the smallest of can sizes internationally sold. For example the smallest (0,225 liters) can of Tikkurila Eko-Joker, a satin matt decorative paint, currently holds up to 10 different languages in its small seal-peal label[19]. Additionally each product label carries a short description of the product, several pictograms indicating different things (e.g. the solvent to be used) and a VOC-marking that shows the amount of volatile organic compounds the product contains. With the small size of the actual can, the printed font on the labels becomes almost unreadable, which naturally doesn't help the marketability of the product nor the end-customer.

With the industrial paints the fundamentals are somewhat different. The industrial paints produced only for the use of professionals, do not require printed information to the same extent that consumer paints. Professional users are more aware of the compounds and chemicals they are dealing with as they often use the same paint products on daily basis. Basically, the products that Tikkurila Coatings markets to industrial users rarely carry any specific instructions for use, and the additional information is provided separately on a data sheet available to the customers.

[19] A seal-peal label: sticker label consisting of multiple layers of printed information, readable by browsing the sticker layers like a book

Also the visual outlook of the labels and the product is not a sensitive issue, and it only has to support the image of the manufacturer. Because of the scarcity of information printed on the product labels, a typical industrial product, such as Temalac ML 90 - a high-gloss alkyd topcoat, can carry up to 15 languages in its label. In some other products/can sizes (20 litres) this number is 17 and could be even more. Such a figure is practically unachievable in consumer paints, where examples of use, preparation and application instructions as well as instructions for the cleaning of the tools used have to be mentioned on the label.

When thinking about the label of a paint product, there are certain pieces of information that have to be straightforwardly available to the end-user. This relatively strictly legislated collection of information is what makes the actual design of the labels very challenging. Not only the ingredients and the chemical compounds the products consists of have to be readably printed, but also a short description of the product, examples of use, preparation and application instructions, as well as information regarding the drying times, coverage, recycling and the origin of the product must be provided. Additionally, also basic information about the manufacturer Tikkurila is given, as well as the contact information of Tikkurila's many local branches. All this creates pressure for the required printing space on the label. One thing that partly eases this pressure and the scarcity of space is the use of icons or so-called pictograms as flags for particular labeling details, e.g. for "interior paint", "water-based" or "use by", etc. Within Tikkurila these pictograms are already widely used for many messages both with industrial and consumer products. Also, it ought not to be beyond the wit of icon designers to propose something acceptable for each meaning. In some products and can sizes Tikkurila still has many possibilities to use pictograms to deliver additional information and different kinds of instructions.

4.7.3. Importance of functional and attractive packaging

Even though the labels of paint cans represent only a tiny share of the costs involved in the process of getting the product on the shelves, the importance of them is not necessarily highlighted enough. As the president of one big label printing company says it; "The quality you put into them is as important as the perfection you strive for in an annual report or an upscale direct response piece"[20].

---

[20] Anonymous author, *American Printer*: Label it efficient, March 1993, pg.45

When giving it a thought, it certainly doesn't seem surprising that companies are very exact on what they want their products' labels to look like. A hundred times more people see the label on a company's product than will ever see its annual report. Also, the label sitting on the shelf is the most important piece of advertising a product itself can have. This in mind, it is no wonder Orion Pharma, a big pharmaceutical manufacturer, has an exclusive department for packaging technology, which is responsible for almost all of the packaging related issues and the completeness of the solution used for each product's package[21].

Because of their nature, no matter how many million you have ordered or you are producing yourself, you can't think of labels as a commodity that must be cranked out the print as quickly as possible. For paint manufacturers in general the batch sizes for labels as well as the end products tend to be smaller, if compared to food products or drinks for example. Also the production-consumption time is usually longer, and all paper labels have to be printed with colorfast ink or otherwise so that they can be exposed to sunlight without their color fading. This is why manufacturers in paint industry are very keen on quality of the prints. Other than that they are merely concerned about the price.

For the industrial products the looks of the end-product doesn't play a role as crucial as it does in consumer paints. This is why there are certain differences also with the postponed labeling processes, depending on what the end-user of the product in question will be. For example, with the industrial product range marketed under the Tikkurila Coatings brand the use of blank spaces in "base labels" and application of transparent sticker-labels is somewhat irrelevant. Conversely, a commonsense goal for the design and manufacture of their labels is to fit in as many languages as possible, and thus maximize the marketability of the sales items carrying so-called basic labels.[22]

Based on the importance of packaging and previously discussed characteristics of the problematic situation Tikkurila is facing, the following chapter will first discuss Tikkurila's current labeling and distribution processes in more detail and present the alternatives for the application of labeling postponement, and secondly give our strategy proposition and recommendations for the company.

---

[21] Interview with Johanna Hamberg, Head of Document MGT and Labeling, Orion Corporation

[22] Interviews with Tikkurila Coatings business support people.

5. Strategy Proposition and Implementation Plan

This chapter concludes what the solutions for Tikkurila's deteriorating problem could be, takes into consideration the drivers and barriers to change and sets up a strategy proposition for the company on a 2-3 years timescale. The idea is to sketch up a scenario where a combination of logistics and labeling postponement would lead to increased flexibility, additional cost savings and increased cost-effectiveness throughout Tikkurila's supply chain. The proposition includes central parts of Tikkurila Paint's international distribution network and focuses on the export channels to the selected countries listed later on. On a theoretical level the idea behind our proposition and recommendations is applicable also with all the other exported paint products. Practically this means that the operational model of postponed labeling could be later expanded to numerous locations internationally, and thus be utilized more comprehensively within the group.

The basic idea in our strategy proposition is to keep (semi-) finished inventory at a central location(s), directly shipping product only on demand (when customer order is received). The flexible inventory would be designated for certain market areas, and could thus be positioned in a distribution center closer to the customer. Within the next years increasing part of Deco International's product range could be stored in these intermediate warehouses in semi-finished form, without the final label components and language variants. All this makes it possible to reserve common inventory for multiple countries on the basis of aggregate demand of the combined markets, simultaneously reducing the risk of having a customized product in the wrong place at the wrong time. Because of fewer total SKU's, the added flexibility would also help Tikkurila to cut down its total inventories stocked throughout the distribution channel.

We start the chapter by going through how the search for a solution got started in the first place and have a short look at backgrounds of this study. This includes a presentation of the idea about modular label design that initiated the thinking process and the interest in the possibilities of postponed activities. Section 5.2 tells the reader why EPR suits so well for the implementation scenario, and why the development towards a more flexible operational model should proceed one phase at a time by first testing the postponement concept in limited scope, where it is most badly needed. After this reasoning, we explain why it is our recommendation and the company's decision to pilot the labeling postponement with the Feeling product family – a central part of Tikkurila Paints' European Product Range.

This is followed by section 5.3, which presents the practical alternatives for the future distribution structure in Central and Southeastern Europe, goes over the identifiable strengths and weaknesses of each scenario, and finally more or less sums up how Tikkurila could proceed in its quest for increased flexibility. After this we review how our proposition would impact the performance of the members of the supply chain, and discuss the direct and indirect cost-savings achievable through labeling postponement. Out of these cost-effects, we then concentrate on analyzing how the costs of transportation would change in the proposed structure for international distribution, and what the effect on consolidated shipments would be. Section 5.5 illustrates the behavior of road haulage costs in two different distribution scenarios characteristic for the current SC and the proposed structure of international distribution.

In section 5.6 we proceed by taking a look at the particular barriers to implement the strategy we have proposed. We discuss the internal and external forces that drive the supply chain and the crucial role of collaborative relationships when managing a change of this scale. Before our recommendations and concluding this chapter we review the possibility to use a third-party service provider in the execution of labeling postponement and shortly discuss the pros and cons related with this option. On the basis of our analysis, the prevailing situation at Tikkurila Paints and the company's available resources, section 5.8 then sums up our recommendations. Finally, we conclude the chapter by discussing the main limitations and constraints of the study, and see how they affect our strategy proposition.

5.1. The Flexible Labeling Initiative

As Van Hoek (1998) suggests, in applying postponement, firms can customize and localize products according to customer demand and local market circumstances from a vantage point close to the market (which is especially relevant when a company operates in varied international markets). This informational advantage enhances the efficiency of various operations, as they avoid uncertainty about the specifications of orders and order mixes. In other words, by applying postponement, Tikkurila could better cope with complexity without having to lower product variety; in fact, they might even decide to expand it. Besides customizing (job shop) postponed labeling operations, those activities that are not postponed (for example, up-stream activities in Vantaa) can be run (like a flow shop) in a mass production environment, thereby maintaining efficiency.

The whole idea of somehow modularizing their product labeling has been maturing in the minds of Tikkurila's staff responsible for the label layouts and other printed marketing materials for many years, and the basic ideas of how it could be executed in practice were already there when research assignment was outlined. At first, the company staff explained us their set of ideas related with the issue. Then they illustrated the limited space for printed information they have to work with and thoroughly showed how the current the label design was at the time. As almost too familiar with the issue, they were also able give some insight regarding the different rules and regulations concerning the informational contents of paint product labels. Thus, with a rather comprehensive set of ideas and given constraints, it was generally easier to get started with the research. Below in the Figure 5-1 one can see the basic idea of modular label design that is the fundamental in regards to operational responsiveness and enables the implementation of labeling postponement strategies:

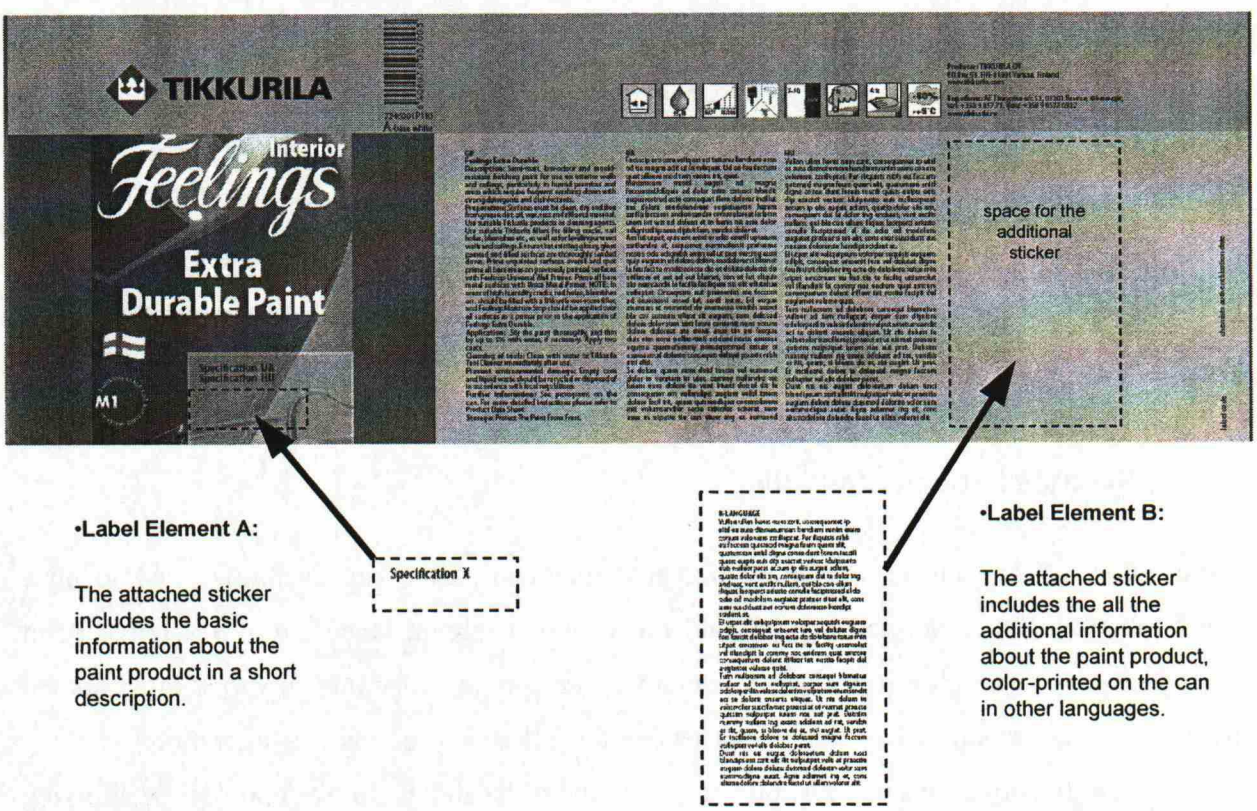


FIGURE 5-1 Illustration of the transparent label stickers used to increase flexibility

The idea behind "flexible labeling", beautiful in its simplicity, is based on the modularity of the label design and the different elements the final layout can be broke down to. To get a more comprehensive idea of the differences between the "base label" and the finished product label, see Appendix 1. In comparison to the label element A, the information on the label element B is

very case sensitive and often needs to be made adjustments and corrections to. This is largely because of the various legislative requirements and guidelines the information has to match. A large part of the printed information has to be approved by the chemists working in R&D department, while some other pieces of information are very sensitive to the regional laws and regulations. In the European Union, paint manufacturers are also restricted by the common regulations and directives set for the member countries. One directive, for example, insists on the manufacturer's name and contact information to be printed on the label. Another regulates the use of pictograms as a means to provide consumers with product related information.

5.2. The Challenging Markets in Southeastern Europe

Problems related with market variety and different countries expecting to have top-quality paint product labels with their native language culminate with the markets in Southeastern European and the Balkan region. Many of these countries have only quite recently won their independence, and are still in search for their true identity. Nationalist ideas and movements commonly bring out language issues up front, and stress the importance of having all the written information available in the nation's official language. Throughout the last 10-15 years this kind of development has been common for many countries that dissolved from the Soviet Union or former Yugoslavia. For Tikkurila, many of these markets possess great market potential, and have already shown promising sales development. For example, in Ukraine the sales have been rapidly growing for many consecutive years and show no signs of slowing down.

In some countries the brand has just entered the markets and is still battling for its recognition. What is common for all the markets is how Tikkurila positions its products as premium top quality imports, often having higher retail price than the competing local brands. These attributes combined with common sense make it rational for Tikkurila to approach these markets with a unified product range, offering the customers the sense of quality and conformity often appreciated in Eastern Europe. Some 7-8 years ago the marketing and sales department put together a product assortment especially tailored for export and the targeted markets. The company's European Product Range (EPR) consists of 26 paint products assembled in four product families (Feelings, Valtti, Kiva, Unica) and some other independent product titles. This selection of Tikkurila's decorative paints of highest quality is sold to some 16 countries in 1 to 4 different can sizes. In total this product range now encompasses 77 stock keeping units (SKU's) that are actively marketed and imported to the selected countries.

Because of the nature of the markets the EPR is tailored for, these markets represent themselves as a great prospect for the implementation of labeling postponement. Almost every targeted market area has its own peculiar national language and thus they present similar challenges in regards to informative product labeling. The EPR assortment is already marketed and sold in considerably more countries and language areas than can possibly be fitted in one product label, this figure of course depending on the can size and the amount of information to be printed.

With the sub brands like Feelings or Valtti the company has aspired to a unified look for each of the product families. With the exception of exports to China, a peculiar market area of its own, this objective has been reached, and these days each of the sub brands marketed under EPR carries their subjective layout. The unified layouts have only helped the marketing of these exports, but the problems with the label contents have undoubtedly been present for years already. As their goal is to provide the retailers and consumers with premium paint products, it is understandable that neat looking, attractive and informative labels that support the image of the company are a necessity when thinking about the whole import offered. And what makes labels more informative and appealing to the consumer than all the provided instructions and ingredients printed in their own local language.

5.2.1. Feelings sub-brand as the pilot venture

The Feelings product family is the main sub brand marketed under the EPR, consisting of 8 different decorative paint products and a total of 26 SKU's. It is one of the many sub brands that are designed from the very beginning to satisfy Tikkurila's wholesalers' and retailers' needs on the international markets. Unlike some of the other product families included in the EPR, the Feelings sub brand has never been introduced in Finland or been used in domestic marketing. Lately the Feelings family has played a central role in the export marketing ventures, being usually among the first product lines that have been introduced in export markets, so far in some 10 European countries.

Earlier, in February of this year, people from middle management, sales and marketing and production planning sat around the same table to discuss the issue of a suitable product group for the piloting of postponed labeling. After discussing the possibilities and pros/cons of the previously described flexible labeling initiative the product managers and the company representatives responsible for European exports decided to pilot the implementation of flexible

labeling with the newly modified Feelings product family. There were many reasons to back up the promptly made decision: there were identified difficulties related with product labeling of these specific products, the characteristics of their current market demand supported "generic" stocks, and the Feelings family was considered to be suitably sized for a piloting project and thus a relatively small entirety that is somewhat comfortable to control. What also supported the selection of Feelings was the fact that within the product family and its basic label layout there were no foreseeable changes to be made in the near future. Also all of the target markets where Feelings is marketed are on the same direction in respect to the Vantaa site and Finland. Feelings is also among the sub brands on which the sales executives have the most expectations regarding sales growth in many of the target markets. All these facts supported the choice of Feelings being the first group of products subject to the supply chain changes resulting from the implementation of labeling postponement. And according to today's knowledge, it will also be the first product line carrying the so-called flexible base label layout and the empty space for additional customization.

Piloting the concept with Feeling of course by no means rules out the possibility to soon apply the concept also in a larger scope. Developing the concept towards practical applications and promising results with Feelings can naturally encourage the company to apply postponed labeling on its exported products to a larger extent. For Tikkurila Paints, after Feelings, Valtti and Unica product families represent the next logical choices for similar applications, whereas Tikkurila Coatings might some day apply the concept in its own way, and thus find answers to the similar problems with smaller can sizes of its industrial product range.

5.2.2. The practical characteristics of labeling applications

After deciding on piloting the concept with the Feelings assortment, the next debate was naturally about the languages chosen to be the fixed components of the new label layouts. As earlier discussed the size of the label's surface area is the key constraint that limits the number of different language versions a product can carry. With the product can sizes varying from 1/3 litres to 10 litres it is possible to have all the required information in readable format printed on each sales item in four different languages. Out of these four languages the last one (latest variant) would bring the desired flexibility to the process, since it would be attached to the color-printed cans only after the customer order is received.

For the EPR marketed mostly in the continental Europe English has been chosen as the general packaging language, and thus all the required information on the labels has traditionally been included in English. With the uniting Europe, English has even more proven its position as the prevailing European language in most of the European societies, and is still the most universal language in marketing. So not surprisingly, out of the almost unlimited choices of languages English was a self-evident first selection for Tikkurila. The choice of the other two fixed languages, on the other hand, resulted in differing opinions and inspired a lot more discussion.

When looking at the big picture and the pure essence of flexible labeling, the choice for the other two fixed languages to be printed on the Feelings products already before the manufacturing and filling takes place actually loses much of its significance. After all it is only two additional language areas or markets, whose needs will be satisfied through the second and third printed language. As expected, for the managers and sales executives the choice of the second and third language was ultimately all about sales figures, market potential and rational thinking.

After multiple modifications, and on the basis of latest sales figures and the growth potential seen, the sales managers finally decided upon Polish and Ukrainian to be the two additional fixed languages. In the next few months the sales department will further examine each paint product individually and see if this set of three languages is the right choice, based on each product's international sales history. In practice this means that most of the future Feelings products will carry English, Polish and Ukrainian label texts in their base labels, on top of which the fourth additional language will be then later attached. Each sales item will thus finally carry all the instructions in total of four European languages.

As already mentioned earlier the Feelings product family includes four different can sizes: 1/3,1,3,10 liters. Out of these four the size of 1/3 liters is only used with the Harmony wall paint, and is currently sold in relatively low volumes. This selection of can sizes supports the use of standardized label stickers (including the additional language) that can be applied with each can size from 1 to 10 litres. For the practical applicability of postponed labeling this is a noticeable advantage. With one-sized transparent sticker where instructions are printed in selected language the company will have the possibility to customize each size of product cans included in the Feelings assortment. In practice this supports the simplicity of the pilot project, as it can be started with only one-size transparent label stickers printed according to the received customer orders. Also when the volumes call for automated labeling processes and a machine that is

capable of positioning and attaching the additional labels, a machine that is only capable of using one sticker size can be applied in the process.

We now narrow our examination to the parts of the SC directly affected by the implementation of labeling postponement. These are the company's manufacturing site, regional distribution centers (or VAL centers), national warehouses, and independent importers' premises. In the following, operations preceding production and retail-level distribution are thus excluded.

5.3. Practical Alternatives for the Distribution of Feelings

The application of labeling postponement relies strongly on the "network" nature of international distribution (see Appendix 2) and the capabilities of the downstream members to perform the decided labeling activities when the demand signal so indicates. At moment paint production for Tikkurila's products takes place in Finland, Sweden, Poland, Estonia, Ukraine and Russia, and Feelings represents only a small portion of the total production distributed through a relatively complex network of different kinds of logistical knots.

The strategy proposition soon presented rests both on the important role of these knots acting as bulk-breaking transshipment points and the "flexible" inventory kept in generic form at these points. Each variation of the future distribution structure suggested in the following is based on the idea of final labeling executed only after the customer order is received. In all the alternative scenarios final labeling is done (if necessary) according to the current order book, which reveals where and on which market the paints, and lacquers are to be sold. If the required language is already among the three pre-printed ones, there is of course no need for further processing. After the additional labeling is finished, the customer orders are successively shipped out, and the customers (if the fourth language is attached) basically receive their lots of products labeled-to-order. In general, this strategy and most of the alternative scenarios next presented will result in higher distribution costs, but lower inventory in the channel.

Within the next few months the managers at Tikkurila will need to come to a decision on how to proceed with international distribution to the EPR target markets and the above-mentioned pilot venture of the Feelings product family. Based on the related theories, previous discussion and the characteristics of the observed environment where the company operates, we will next construct four basic future scenarios to help the managers in their decision making process. Later on we

will cut down our analysis to the two most appealing alternatives, and discuss why the other two do not satisfy Tikkurila's needs nor help us in truly achieving our research objectives.

In the following Table 6 all the four basic options for the company are listed and evaluated:

TABLE 6. Alternative future scenarios for Tikkurila's product labeling and distribution

The Pros and Cons of each implementation scenario	**Scenario 1:** Labeling operations are executed as to this day: integrated in the flow process of production at the manufacturing plant	**Scenario 2:** Final labeling and customization takes place at the manufacturing plant, but only after the customer order is received - separate process	**Scenario 3:** Final configuration and postponed labeling is executed centrally in central warehouses (VAL centers)	**Scenario 4:** Deferred labeling is executed wherever the customer (wholesaler or retailer) prefers; in local or central warehouses, or both. (Hybrid model)
Product labeling is finished...	centrally at the production line and products are manufactured to buffer stock	centrally at the last possible stage of production process	in a centralized mode, at the regional DC/central warehouse (e.g. Budapest)	in a decentralized mode, where Tikkurila and the customer organization agree on
Added flexibility	None	Low	Medium	Medium
Variation point's closeness to customers	Low (Far away)	Low (Far away)	Medium	Medium-High (close to the market)
Speed of delivery	Medium	Low-Medium	Medium-High	Medium-High
Benefits (+)	Economies of scale in production Quality assurance is more transparent and products easier follow No need for additional investments	Some inventory savings through "flexible" buffer inventory Local quality assurance No need for investments abroad	Increased flexibility in the SC Inventory savings through "flexible" stocks Economies of scale in production and distribution savings in inventory with high customer service Possibility to assure the labeling quality centrally	Increased flexibility in the SC Customization possibility on the national level Inventory savings through "flexible" stocks

Disadvantages (-)	No added flexibility into the labeling process No answers to the deteriorating situation caused by increased internationalization Increasing problems with accumulating SKU's	Relatively big inventory between manufacturing lines and additional labeling line Products are stocked relatively far away from the customers in a semi-finished stage	Transportation arrangements from the regional DC's have their challenges For some product deliveries this would mean just another middleman	Difficult to check the quality of the final labeling The level of cooperative operations may vary Transportation arrangements from the regional DC's have their challenges
Distribution mode Distribution costs (road haulage)	Direct deliveries to national warehouses Relatively High	Direct deliveries to national warehouses Relatively High	Deliveries to regional DC that distributes goods to national markets Low-Medium	Direct deliveries and deliveries through the regional DC, order-specifically Medium
Inventory structure (manufacturing operations) Inventory costs	Centralized manufacturing & international distribution warehouses High-Medium (due to a high number of SKU's)	Centralized manufacturing & international distribution warehouses Medium (due to a lower number of SKU's)	Centralized manufacturing operations for paints & postponed final manufacturing in international distribution centers Medium (due to central regional inventories and buffer stocks at the manuf. plant)	Centralized manufacturing operations for paints & decentralized postponed final manufacturing Medium-Low (due to a low number of SKU's and lower buffers in the regional DC's
Overall controllability of the operations	**Easy**	**Relatively easy**	**Somewhat challenging**	**Very challenging**

Because the subject of this thesis concerns postponed manufacturing, and we are especially interested in practical applications of Pagh & Cooper's (1998) *manufacturing postponement strategies*, it would not make much sense to further discuss the labeling applications executed on the original production site. And since only the scenarios, in which product labeling is finished outside of the production site at Vantaa actually increase the flexibility in the SC, we think it is justified to from hereon concentrate on the two leftmost scenarios (presented in Table 6). Thus, the next sections will discuss these two scenarios in more detail.

The constructed two future scenarios aren't true substitutes to each other and the actual network structure to be seen and operated in real-life can be something in between these characterized

optional alternatives. In the following we have merely summarized the central issues, our main ideas, and pros and cons concerning both alternative courses of action. The idea is to present two alternative solutions and directions for the actions to be taken in the following 6-18 months that clearly distinguish between each other.

5.3.1. Alternative solution #1 – Centralized labeling postponement model

Restructuring and mode-changes are always easiest to implement in the set-up phase of a channel member (a distribution center). Thus, future expansions to the current network play a key-role in the possible implementation of postponed labeling. In this sense Tikkurila is on the move at the right time, as it has lately invested considerably in the expansion of its logistics center in Budapest, Hungary (to be operational by the end of 2008). In this alternative this warehouse expansion (currently under construction) would act as a distribution center to the Balkan region markets, and thus would suit for additional labeling. Besides serving the Hungarian markets this logistics center could handle the distribution of EPR to the near-by countries and opening markets elsewhere in the Balkans and Southeastern Europe. When the new warehouse expansion is up and ready, the setting up of an additional labeling line will be the next step. The center should be able to process the undesignated paint products into their final form by customizing generic SKU's according to customer orders. In practice this is done by taking care of additional labeling and possibly handling the group packaging of smaller cans (1/3l & 1l) right on site.

Because of its central role in European distribution of Tikkurila's product range (in the future not just Feelings), the VAL center in Budapest would have to be equipped and designed to handle high volumes. Therefore, the warehousing facility needs to have sufficient available space and room to accommodate modern automated labeling machinery. The idea of centralized operations relies on the benefits obtained by efficiently handling high volumes with a low cost margin (overhead and variable costs). In this case it would be using common resources for the mass-customization of the selected product groups. And what it takes is large enough capacity for the center to proficiently handle the physical product flow heading to each of the designated markets. Figure 5-2 illustrates the position of the point of product variation in Tikkurila Paint's European distribution network, and indicates the possibility to later on create similar VAL centers to serve other sectors of the international markets. The relatively short distance from Budapest to the target market areas allows rapid deliveries and helps to considerably reduce the delivery lead-times.

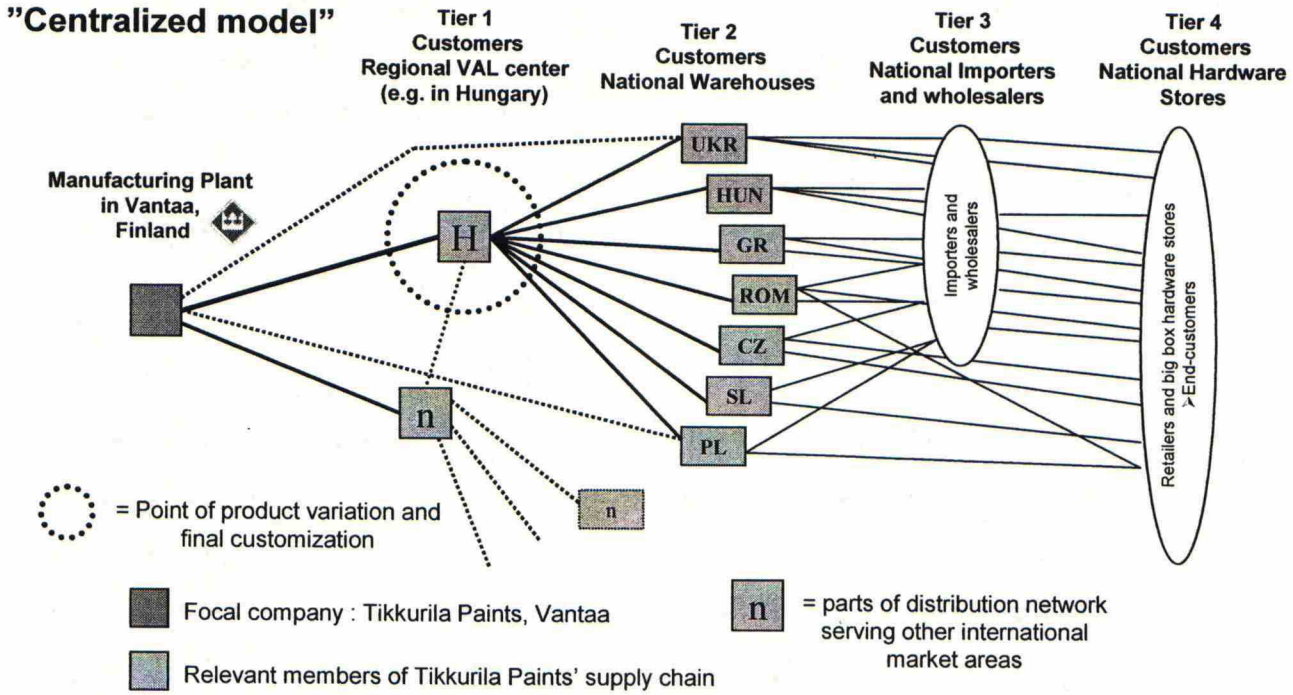


FIGURE 5-2 The centralized structure of Tikkurila Paints' distribution network

The above-depicted centralized structure would rely on efficient road haulage deliveries from the Vantaa factory. In other words, the network would need regular bulk shipments from Finland to Budapest to maintain the desired buffer stock. Depending on the sales growth within the next few years, this would practically take weekly-monthly FTL deliveries to ensure the availability of each product type included in Feelings. If other product lines are to follow, the delivery rate will increase significantly. From the centralized regional inventory deliveries of finished products could be made to both national internal (subsidiaries) and external (importers, wholesalers, retailers) customers. Concurrently, actual paint production could more rely on aggregate demand and increasingly gain the benefits of economies of scale. The actual number of production items and SKU's to be stocked would in fact decrease, while at the same time, the figure for internationally marketed sales items would level or even increase. This is of course what the flexible labeling enables, and would be achievable with other distribution structures as well.

Controllability and straightforward procedures help on the feasibility

Centralized labeling operations have many strengths, but maybe in the international competitive environment of the case company the most significant one is its controllability. When each international customer account has similar delivery procedures and fundamentally follows the same order-delivery process, it becomes a lot easier to follow-up on customer deliveries and then to make order-specific exceptions if necessary. By this we mean that it's favorable to primarily

serve each customer of the same European market area from the same regional central warehouse, and only make direct deliveries and exceptional delivery arrangements (use some exclusive mode of delivery) when some (high volume) order specifically calls for it. In practice this means that an order of an large Hungarian retailer chain, containing selected sales items in large volumes, would be best to deliver straight from the Vantaa factory with a direct delivery to the customer's premises.

Also quality control would be more transparent as each finished product could be physically observed before leaving the company's facilities. Thus, the quality of the throughput of re-labeling operations could be checked formally, and the outlook of the finished sales item would never rely on the motivation or exactness of some external actor (such as independent importer or local retailing company). This way misplaced label stickers and poor work resulting in inferior outlook of the final product could be avoided, being sure of the quality that leaves the company.

Other than Hungary, on a global scale there would be many other optional locations for similar labeling units attached to larger warehouses and distribution centers. From the current locations dealing with Feelings product deliveries Tikkurila might think about Estonia and Poland and their potential as a future delivery hubs. Playing an analogous role in the SC these knots in the distribution network would have a decisive role in the flexibility of Tikkurila's future deliveries. By having reasonable levels of non-committed stocks these DC's with labeling capability could both smooth down the demand that the production plants see and increase the service level of the entire distribution network. This we think is achievable, because deliveries on average could be dealt with in shorter amount of time, thanks to the "generic"(semi-finished) buffer stocks in regional warehouses. Moreover, the overall inventory costs would be on medium level: although buffer stocks are kept up in few locations, the savings achieved through the flexibility of semi-finished stocks would largely revoke the costs resulting from the upkeep of centralized inventories.

The exceptions with the most significant markets

What is also depicted in Figure 5-2, are the alternative delivery routes to the subsidiaries in Poland and Ukraine. These exceptions to the centralized model of European distribution are justified because of the significant sales on the respective markets. Poland has for long been a very good market for Tikkurila Paints and the export figures to Ukraine have been more than promising. With Polish and Ukrainian amongst the three languages pre-printed on the paint cans

already at the supplier's premises, there would naturally be no reason to ship the orders heading to these large markets through a central warehouse in Hungary. And even though both of these markets have already welcomed Tikkurila's imported product range, the potential is still much bigger considering the rising standard of living and the vast population (38 and 48 million) of both countries. If some other market area passes by in terms of annual sales and Polish or Ukrainian are decided to be replace by the national language of the country in question, the volumes that the subsidiaries in Ukraine and Poland currently face and will face in the coming years would probably already justify equipping the respective warehouses of national subsidiaries with a labeling line capable of handling (positioning and attaching the labels) large product lots. In the long run, such distribution facility would naturally be suitable for each significant market area that has its peculiar language (that is not amongst the pre-printed ones) but is willing to have international quality brands available for the local consumers.

The challenge of delivery reliability

Manufacturers usually measure on-time delivery as the percent of customer orders shipped when promised, in other words as the frequency with which delivery-time promises are met. Usually the level of 95 percent is considered as a target level for companies dealing with consumer goods. For Tikkurila most of the early challenges related with the implementation of postponed manufacturing operations have something to do with the reliability of customer deliveries; their consistency, success rate, and timeliness.

What is it then that makes it so challenging to arrange the final customer deliveries to go as smoothly as envisioned? For this there is no one single answer, but several issues that might initially cause problems in the distribution of finished paint products. First of all, the warehouse in Budapest has so far only been used for deliveries to retailing locations in Hungary and Romania. Now it is suggested to have a role as regional hub, beginning to serve the customers of seven nations and a network of hundreds of retailers. This geographical dimension brings its spice to the soup and brings a lot of issues to be solved with it. Distances and transportation routes from Budapest to customer locations vary a lot, and it might take extra effort to find suitable logistics partner to take the transportation responsibility, not the least because of the semi-developed infrastructure of the Eastern Central-Europe. Many of the well-known logistics giants (like DHL or Schenker) familiar to the company might not have services available for all the required routes (from Budapest, Hungary to Inofita, Greece, for example). And even if the road haulage of the route can be arranged, the logistics partners probably don't have available

listed prices ready, and thus the planning and price negotiations may take considerable amount of time.

Despite the above-mentioned challenges, the centralized distribution structure unarguably has many advantages due to the consolidation of shipments, the customizable stocks close to end markets, relatively good controllability, etc. Still, we don't imply that it would be the only reasonable way a paint manufacturer could add flexibility to its SC operations, because in practice there are a countless number of different distribution structures, which can accommodate the concept of labeling postponement. Next, we present one of them in another alternative scenario for the future of distribution, not the least to argue for the first presented alternative.

5.3.2. Alternative solution #2 – "Hybrid" model for distribution

Another course for the development of the current distribution network would rely on the capabilities of smaller independent players of the SC. Alongside the DC in Hungary postponed labeling would purposely be implemented in a much more decentralized manner: some of the national subsidiaries, their national warehouses, and some of the independent importer companies would be equipped with necessary labeling machinery and ensured to have other required resources. This so-called "hybrid model" of labeling postponement would rely strongly on the cooperative capabilities and the informal nature of distribution execution. After each partner is selected and ready for such teamwork, the first step would be equipping the partners with the required printers, necessary labeling materials and possible supporting machinery.

When new roles, common goals, work instructions and the intentions behind postponed labeling are clear to every partner, everything is set to go. Ideally the network processes the generic SKU's wherever it is the most reasonable to do so. In other words, the decision for each products delivery route and customization point is order-specific, and each customer order is reasoned independently before deciding upon the delivery. In practice each customer account would be designated to a primary route for deliveries and secondary option would be considered if some reason hinders the delivery through the primary option. For example, if a Romanian importer orders a large lot of Feelings Extra (interior paint) in various can sizes, and the stock levels in Budapest are found insufficient to fill the order, the sales executives responsible for the Romanian customers can decide to manufacture the ordered product lot within a week at Vantaa, and deliver the order with a separately arranged direct shipment to the customer in Bucharest.

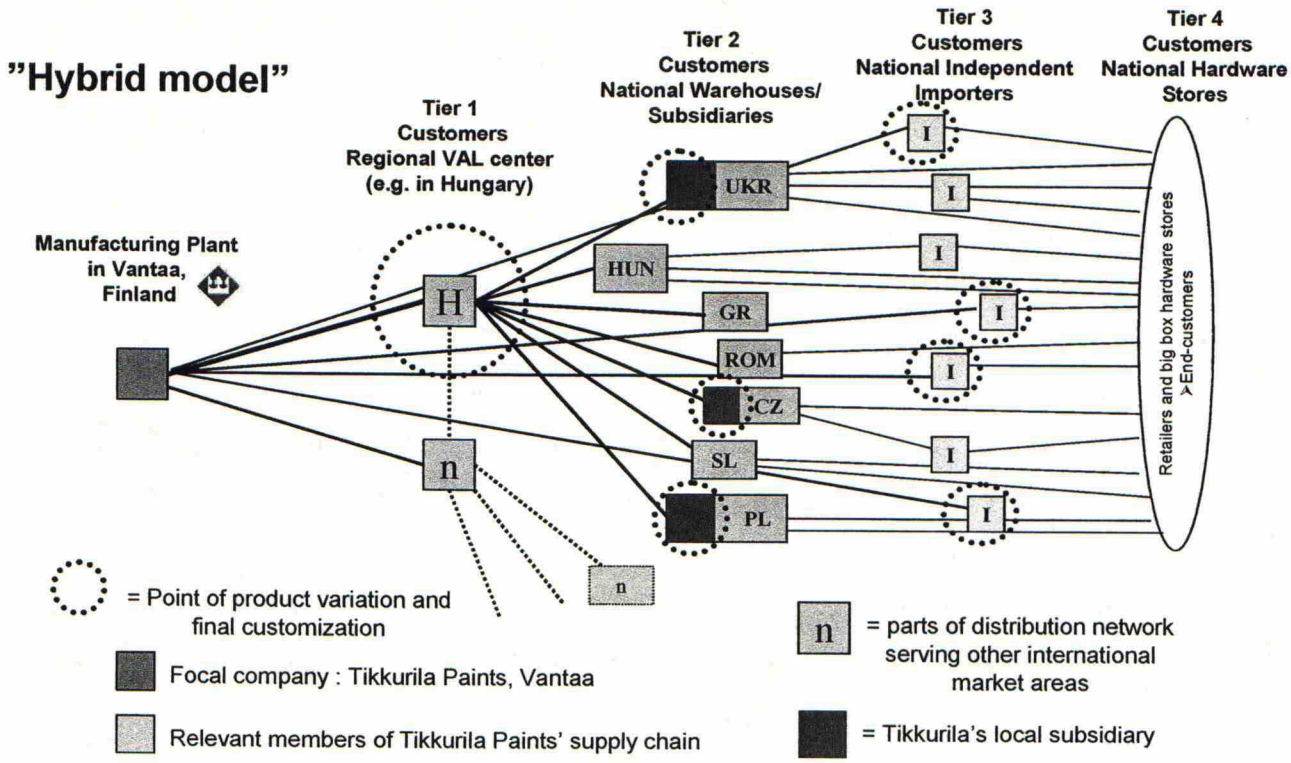


FIGURE 5-3 The "Hybrid model" for Tikkurila Paints' distribution network

This model for distribution relies on the capability of the smaller partners to finalize the product labeling with the help and use of selected type of sticker printers (see Appendix 4 for exemplary equipment). With the appropriate labeling equipment these logistical knots in the network could receive product lots equipped with only so-called 'base labels' and further label and customize them with stickers containing market-specific information (language x). The labeling line set up in the Hungary warehouse could here act as a supporting facility used for high volume orders distributed through the regional DC. With various delivery options, the actual delivery process and the point of product variation in this model can be different for each order. The labeling (final customization) location varies from the importer to the original manufacturing plant, and as a result, also the delivery times can vary considerably.

Small but important dealers and importers

One thing that speaks for the use of low value sticker printers and low initial investments when starting to implement labeling postponement is nature of many of the national middlemen. As is typical for the paint business, the market for products is very scattered and in many countries there is still space for smaller players and entrepreneurs. Especially in countries, which are only gradually opening up for the western companies and products it is very common that the importers of Tikkurila's products have started up as small ventures and have then expanded their

operations if the business environment has turned out more favourable. These small time players in the paint importing business are still essential for Tikkurila's position on many markets. Their importance can be even further stressed when the markets have been only recently entered and reliable forecasts for the future sales cannot yet be made.

When considering the implementation of postponed labeling from the importer's viewpoint, the significance of the initial investments is emphasized. The smallest importers have neither rational reasons nor intentions to invest tens of thousands of euros into labeling machinery[23]. This is why the designed implementation has to have alternative applications for the use of the intermediaries too small to economically utilize the machinery included in an automated labeling line. Fortunately, the planned implementation phase doesn't necessarily require any expensive automated machinery, but is instead applicable with the only a small but capable sticker printer. Per location, the initial investment would be reasonable, as very efficient label printers are available in prices starting from around 3,000 euros. Because the no colours are needed for the transparent label components, the application can count on printer equipment (see Appendix 4) capable of rapid greyscale printing on reels of specially designed label stickers.

If the management decides to develop the system more towards this "hybrid model", the following things should be emphasized. In the first phase of the implementation strategy Tikkurila should provide the smaller players of the distribution network with only the above described sticker printer and an access to a shared database with the up-to-date label information. Without the access to the current label versions there is always the risk that some faulty, outdated or otherwise invalid label information is printed on the products and reaches the eyes of the end-customer. In today's business environment it is easy to recommend that the database that stores all the required label texts and information in all the necessary languages is designed to function electronically, and be effortlessly accessible for all the partners. With societies becoming more accustomed to services available only through the Internet, the database should also be accessible through the Internet from each country where Tikkurila's paints are sold. And even if in the end the workers of the intermediaries do the actual labeling manually, the process makes simple sense, leads to good-looking packaging, and helps Tikkurila to support its premium brand on the European export markets.

---

[23] Interview with Mila Käkelä, Sales Executive for Ukrainian markets

Controllability and quality control as main concerns

What is evident with the scattered "hybrid model" is the challenge of controlling the quality reaching the customer in the end of the distribution channel. When the final labeling operations take place in multiple locations and in some instances outside of the control of Tikkurila, the ultimate quality of the branded product becomes an issue. If an independent importer, in Slovakia for example, is to take care of the additional labeling, it is more than difficult for the sales people at Tikkurila to ensure the quality of the work done. Practically, it becomes more or less impossible to ensure that the final product looks like it should and the label stickers are correctly placed. This is why the managers should carefully consider if all the manufacturing activities are still best to keep within the reach of the company, and thus restrict postponement to the level of regional warehouses and national subsidiaries.

Another essential thing is the entirety of the European distribution, and the rules of the game that each sales office would share and could rely on. What we mean by this is a simple protocol on how each market area and each customer is served and how their respective orders are to be processed. And if such rules are missing problematic situations will easily emerge. When each order is treated individually and the company lacks proper guidelines for the sales people, it is more than likely to end up in a situation, where delivery reliability suffers, customers experience the service level decreasing, and important deals and customer accounts are ultimately lost to competition.

5.4. Impact of Labeling Postponement on Channel Members' Performance

When we focus on the impact of postponement solutions on channel members' performance, we have to look at the supply chain as a whole, and not to get tangled with increased costs and extra investments on some level, but to see the total impact labeling postponement on the profitability and cost effectiveness of the channel. Practically this means that in addition to the required investments in the downstream operations of the SC, we should comprehensively consider all the other existing performance factors. The conventional calculations are based on the required investments and obtained cost economies. Yet, the marketing values can remarkably increase profitability through price premium and additional sales (Helander 1999). This is why we think marketing values should also be included in the performance analysis. Thus, we divide the performance factors related with labeling postponement into three categories: investments needed, cost economies and marketing values, and discuss them in that order.

5.4.1. Investments

Zinn (1990) argues that the size of the investment depends on the postponement type chosen and capacity of the alternatives available. He suggests that one approach to computing the impact of capital investment is to include the annual cost of capital in the calculation of the cost of the postponement application. In the paint business, the price of an automated labeling machine varies between 40 and 160 thousand euros, and is thus estimated to be 15-50 times more expensive than an efficient sticker printer. Because of the large investment required, an automated labeling line is considered suitable only for large distribution center. On the other hand, also the capacity of automated labeling lines can be ten times higher than those relying on printers and manual labeling. In addition to investments in pure labeling equipment, group packaging machinery and palleting robots are required in fully prepared automated labeling lines.

5.4.2. Cost economies

First of all, through postponement, transportation costs can be reduced (Zinn 1990). In traditional distribution, a forecasting error causes misallocations within the channel because products are supplied to stores on the basis of sales forecasts, creating stockouts in some stores and overstocks in others. According to Helander (1999), typical quick fixes in these situations include costly transfers between stores or price reductions of non-cycling products. To some extent this thinking applies also with postponement and misallocations between regional warehouses with product inventories. Also through the decreased number of different generic SKU's delivered to DCs, consolidated shipments can be used in deliveries.

Moreover, high service level is obtained with labeling postponement because stocking generic products doesn't require a huge amount of working capital. Therefore, stockouts are rare, which decreases the lost margins of the main and related items. Because generally less inventory is required, both advantages of reduced working capital and less shelf-space needed are obtained. With batch sizes at the factory not really being affected by the postponement of labeling, the processing costs at the factory remain unchanged. The working duties at the point of product differentiation, on the other hand, increase and some extra workforce has to be used. As for other diseconomies related with postponed labeling activities, some training is required for the warehouse labor.

As for the savings achievable through the use "generic" buffer stocks, the following should be noticed. Basically, in the centralized model, some anticipatory logistics are applied, since products are distributed and stocked in a centralized distribution system, in anticipation of future customer orders. While inventory is reduced in terms of the number of stock keeping units, the costs and complexity of the customer order processing then again, most likely, will increase (Bask 2001, 471). Further, the effect is a reduced total value of inventory and a simplification of the inventory planning and management. While more complexities in the SC emerge, some practical things have to be made simple but effective. This however, requires careful planning and execution of the selected practical labeling postponement application, which typically incorporates considerable costs.

5.4.3. Marketing values

Postponement in the distribution channel creates many marketing values for manufacturers and distributors (Helander 1999). When products are labeled in response to customer orders, the firm can improve the customer's choice of products and keep up a more extensive product assortment. With a wide product range, the channel members can differentiate from competitors and get away from keen price competition. Also, if final configuration is performed in a DC closer to the end markets, quick deliveries can be offered because also special slowly moving products can be stocked. On the other hand, unexpected deliveries to locations with only small random orders are much easier to carry out. This is because of the centralized generic inventory that can quickly be customized to fill even the smallest orders. This can be a significant benefit for Tikkurila when it considers the market opportunities in countries in close proximity of the Hungary DC. For example, small customer accounts in Croatia or elsewhere in the former Yugoslavia that earlier could not be served, could now be delivered customized products even in the smallest quantities.

As for the manufacturing operations performed downstream in the supply chain, economies of scale will be reduced. However, economies of scale in logistics will not change greatly. Next we'll have a look at the costs that can be directed to the international transportation of Tikkurila's Feelings products (either finished or semi-finished goods).

5.5. Transportation Costs in Two Different Scenarios

When the point of final product differentiation is moved downwards in the SC, the cost structure of transportation and the whole logistics chain changes. Each additional road transportation kilometer increases the incurring costs for each and every order. Basically, it is easy to say that shipping products via a regional DC is more than likely to be more expensive than deliveries done directly to the national customer organizations. To have a better approximation of the cost effects we developed a model reflecting the transportation costs arising from the combined sea-and-road transportation within Europe. The alternative distribution models were then compared and examined using the estimated flow of the goods relevant for the piloting phase of postponed labeling.

Tikkurila and its parent company Kemira have for long bought the transportation services from outside logistics service providers (LSPs), and this is why the prices used in the model are based on a survey and the 2008 request for quotation round jointly executed with Kemira. Based on the prices for a double-decker truck[24] full of packaged paint products we were able to estimate the logistics costs of the international freight flows from the Vantaa plant. In the prices were included all ADR fees, fuel surcharge and heating charges according to the price listings received from the different LSPs. On the basis of the sales in 2007 we estimated what the size of the markets for the Feelings product family in 2008 will be, and constructed market-specific estimations for each country included in the piloting phase. On top of last year's sales figures the sales estimates also reflect the subjective views of the sales executives responsible for each export market. For comparison we calculated the logistics costs for both distribution network alternatives and created the following scenarios.

5.5.1. Scenario A: Distribution using direct market deliveries

The first scenario is based upon the current structure of international distribution (see Figure 4-4), which has been traditionally used with all export customers. The great majority of Tikkurila's exports from Vantaa are currently delivered directly to the target market with the subsidiary or customer organization as the recipient for the order. Naturally there are some exceptions to this basic rule, and some smaller customers in countries with only small volume orders for Tikkurila's

[24] Special trailer equipped with sidebars that enable the loading of paint pallets on two floors without risking the condition of the transported paint products.

paints receive their shipment via regional warehouses in neighboring or nearby countries. Slovakia, for example, receives much of the goods from through Czech Republic and company's Romanian customers have been served from the company's warehouse in Budapest, Hungary. Still greater part of the exports is being executed with direct market deliveries, often in LTL[25] volumes.

The biggest strengths of this mode of exporting are the following: road transportation kilometers are minimized through direct delivery routes through the Baltic region, the incurred shipping costs are easy to match with their respective customer orders, and no intermediate stocks need to be kept up in between the manufacturing site and national recipient of the paints. Most of the international customers also know when they can expect to have their orders delivered and how often the route is driven. For example, currently there is a truck normally leaving from Vantaa to Kiev (Ukraine) every Friday. For the transportation coordinators it is also easier to deal with each country more or less independently, which on the other hand often leads to sub-optimal decision-making and truckloads clearly short of the maximum capacity and the most economical shipment size.

Then again, the mode relying on direct shipments has its weaknesses as well. There is no denying that it often makes little sense to have many small shipments delivered separately, especially if all the customers are located for example in the Balkan region. Consolidated shipments are often a much more rational and economical alternative, particularly when there are a number of shipments heading to the same direction. FTL[26] is always the desired option in road haulage with longer distances, on the condition that the unloading of the shipments can be executed efficiently and in an economical way. In the calculations of Appendix 3, we have estimated the annual road haulage costs if the sales growth in the area continues as expected[27].

This scenario is also lacking the support for the flexibility generated into the SC, and does in no way enable mass-customization of paint products downstream in the distribution channel. Practically, the topic of this study could as well be forgotten if all the products would have to be shipped as finished sales items, and no space for any additional flexibility would thus be created.

[15, 16] LTL = less than truckload; FTL = full truckload

[27] The calculations are partly based on subjective expectations of the annual sales in 2008

5.5.2. Scenario B: Distribution through a VAL center located in Hungary

Postponed labeling strategy relies heavily on value-adding operations executed in premises closer to the customer markets. In Tikkurila's pilot project the value-adding DC in Hungary matches the above description and takes the role of the final product differentiator (see Figure 5-2). Logistically this model for distribution requires more transshipment and more consecutive shipments, and thus requires more cost generating road haulage kilometers. The central question is how much the costs for road transport will increase in the future if Tikkurila's Feelings products are all shipped through the DC in Budapest?

We started to examine this scenario by looking at the prices given out for transportation lots from Finland to Budapest. The price for the nominated LSP for the route Vantaa-Budapest was approx. 2405 €/FTL double-decker truck (incl. ADR, fuel and heating surcharges). The calculations are based on 22-ton (max.) truckloads, and give out price approximations for the flow of goods heading for each market through the DC in Budapest. For the year 2008 some 309 tons of goods (Feelings products) are expected to be delivered to customers in Central and Southeastern Europe, and just for the transportation to the Budapest hub the annual costs for Tikkurila will rise up to approx. 34 000 euros. In practice and real life this kind of transportation volume would mean the following: approximately 14-15 truckloads of just Tikkurila's Feelings products each year, a FTL shipment (22 tons) from Vantaa to Budapest about 1,2 times each month.

We found it somewhat difficult to estimate the prices for shipments done from the Budapest DC to target customers. Generally the infrastructure in the Balkan region and Eastern Central Europe can still be described as undeveloped in comparison to Western or Northern Europe. This is detectable when you try to start mapping the costs and LSP prices for different road haulage routes. Even the major 3PL partners operating in Europe have difficulties in listing their service prices for miscellaneous transportation routes in the East. Unfortunately, even the local Tikkurila offices in Budapest were unable to give us the relevant price information. This, among other things made it challenging for us to construct this part of the model. Still we were able to complete some estimation, and thus compare the given scenarios.

If the current scenario with direct deliveries amounts to a directional figure of 44' euros (see Appendix 3), and the respective calculation for the consolidated shipments to Budapest amounts to some 34' euros annually, we see there is only a cost difference of 10' with no customer-

deliveries included in the second scenario. Naturally, the final distribution step from the Budapest DC is likely to be more costly in means of tons/km. This is because of multiple LTL shipments with various LSPs providing the needed transportation services. The actual cost effect of the concluding customer deliveries would probably fall between 15' – 20' euros/annually, and would thus reflect with total annual costs totaling between 49 and 54 thousand euros.

Practically, this means that the actual benefits of the centralized model (reflecting in increased performance of the SC; higher service level, sales growth, and decreased inventory costs) would have to annually sum up to some 5 000-10 000 euros, and thus outweigh the slightly increased annual transportation costs. On the basis of our analysis we believe this to be more than probable, and consequently give our recommendation accordingly.

5.6. Barriers to Implementing Responsive Systems

In reality, today's best supply chain practices do not reflect either extreme anticipatory or responsive design. Most established firms remain, to a significant degree, committed to anticipatory practices. However, responsive strategies are rapidly emerging. Bowersox et al. (2007) argue that perhaps the greatest barrier to adopting responsive arrangements is the need for publicly held corporations to maintain planned quarterly profits. This accountability naturally creates expectations concerning continued sales and financial results. Such expectations often drive promotional and pricing strategies to "load the channel" with inventory to create timely sales. On the other hand, it is never timely to make a major reduction in channel inventory and suffer the short-term setbacks. All the efforts to lean or deload inventory to implement a more responsive operating posture require the ability to absorb a one-time sale reduction among supply chain partners. This considered, start-up ventures are often ideally positioned to implement responsive fulfillment systems because they do not face the deload challenge.

A famous line originating from a cartoon is "We have seen the enemy, and it is us!" Unfortunately, this statement is true for many firms when it comes to modifications or other disruptions in the supply chain. These internal disruptions then cause unwanted supply-chain dynamics. A firm's own operations can be the culprit in what becomes the source of constant dynamics in the supply chain. Typical internal supply-chain disruptions like internally generated shortages, engineering changes, new product or service introductions, product or service promotions, information errors impair the performance of any supply chain (Krajewski &

Ritzman 2001). In an efficient (lean) supply chain, however, such disruptions are particularly costly because suppliers are less able to react to changes in schedules. Because supply chains involve so many firms and separate operations, it is unrealistic to think that all disruptions can be eliminated. Nonetheless, the challenge for supply chain managers is to remove as many disruptions as possible and design a supply chain that minimizes the impact of those that they cannot eliminate.

Another often mentioned barrier to implementing responsive operations is the need to establish collaborative relationships. Most business managers simply do not have training or experience in development of collaborative arrangements designed to share benefits and risks (Bowersox et al, 2007, 15). While managers generally express a high degree of belief in the long-term potential for responsive alliances, they typically confront considerable frustration concerning how to implement such supply chain arrangements. So far most firms have implemented strategies that combine anticipatory and responsive supply chain arrangements. This will not change for the foreseeable future, but the trend toward increased involvement in responsive arrangements with specific customers and suppliers will continue to grow.

5.7. Applicability of 3PL

Companies throughout the industries today seek ways to enhance their performance by outsourcing logistics services. Out of them many are planning to, or have already decided to spin-off operations like labeling, packaging or final assembly, and thus employ the a manufacturing postponement strategy. But as Pagh and Cooper (1998) stated, separation of manufacturing stages emphasizes the importance of coordination between the separated stages. The decision then becomes a trade off between cost savings from postponing final manufacturing stages and increased costs because of increased required coordination and lack of economies of scale from separating stages

While the application of manufacturing postponement has increased considerably, more and more third-party providers with capabilities of performing operations such as labeling and packaging, and in some cases even light manufacturing and final assembly, have emerged. Many of them are offering these services at a very competitive price level and quality. In value-adding extra services, such as manually executed postponed labeling would be, that require no special pragmatic skills and are comparatively labor-intensive, it is very common for modern companies

to turn to some external partner that is capable of providing the needed services. For example Exel Logistics repackages bulk chemicals, customizing in the language and complying with the hazardous material regulations of the customer (Twede et al. 2000). This outsourcing option often seems even more appealing if the bought services can be performed in other premises not belonging to the buyer company's supply chain. Generally speaking, these third-party logistics (3PL) providers can be seen as supportive supply chain members. As companies focus on their core competencies, 3PL services should essentially be specialized in effective and efficient movement of products. This implies that logistics service providers should support alternatively supply chain strategies.

According to Bask (2001, 480) one notable trend of the 21st century has been that the 3PL providers have been increasingly active in offering different services in terms of light manufacturing as well. For Tikkurila, 3PL's thus provide an alternative to the execution of product customization. The actual service can include extra labeling with stickers or paper labels, re-packaging, re-palleting or activities otherwise related with late-differentiation. Moreover, these services can be performed externally, in premises that have been particularly designed for this. Thus, before each decision on how a specific market is to be served the company should consider the option of using an external service provider for the execution of additional labeling operations. In countries and locations where company's own resources are scarce and labor generally inexpensive, the outsourcing alternative becomes all the more advantageous. Despite the attractiveness of the situation, careful evaluation of the costs and benefits of the 3PL alternative is still considered very much necessary.

5.8. Recommendations for the Case Company

First of all, the management responsible for the decisions concerning the flexible labeling venture need to believe that change is necessary. They will also need the courage to shift to the new operating model and expand it if desirable outcome follows and the application is successful. Furthermore, on the basis of our analysis and the situation in progress at the company, we give the following recommendations:

- Test and pilot the concept in limited scope (Tikkurila Feelings)
- Immediately start developing the capabilities needed for the use and upkeep of a common packaging material database

- Shift to using a base label design carrying 3 + (1) languages
- Organize the EPR deliveries through a centralized distribution channel, using the Budapest warehouse as an value-adding logistics center
- Appropriately plan all the practical issues related with the implementation
- Make sure of the availability of sufficient resources

As listed on the top, we believe Tikkurila should next concentrate its efforts to the implementation of its piloting project with Feelings product family. This would involve shifting to the use of new tin-plate cans in their production process - carrying only the selected base label layout, i.e. English, Polish and Ukrainian as the three pre-printed languages. Additionally the new layout should include the extra space reserved for the texts printed on transparent label stickers. This solution enables direct deliveries to both of today's most significant markets: the vital customers in Poland and the rapidly growing market of Ukraine.

To support the flexible labeling and the practical upkeep of all the information used packaging materials a shared database is required. Furthermore, Tikkurila should at once proceed with the reviewing and selection of appropriate database software, so that a working solution and a common database accessible for the relevant stakeholders could be developed in time for the actual application phase of labeling postponement.

As for the distribution structure supporting the application of labeling postponement, our number one choice for Tikkurila's future development is the centralized model of distribution, using the DC in Budapest as a value-adding-logistics center. The centralized distribution through the central warehouse in Hungary would be logical and make sense also regarding the transportation and its cost-efficiency. Consolidated shipments of "generic" products could be used to keep up the desired buffer stock at the DC. These shipments would without exception be executed with full truckloads, and thus the efficient use of transportation capacity would be guaranteed. Also the geographical location of Budapest suits particularly well for serving the needs of the near-by markets, such as Hungary, Romania, Czech Republic, Slovakia, and Ukraine.

Additional strengths of the centralized distribution model include the following: one unified protocol could be applied with exports to the particular region; the controllability of the model is superior to decentralized solutions; it opens up new market opportunities in the near-by countries; and it helps to attain the additional cost economies achievable through labeling postponement.

As soon as the construction work of the additional warehouse facilities in Budapest is completed, the positioning of the needed labeling machinery and other practical issues related with the application should be carefully planned. And when all the preparations and required equipment is finally ready, the company should allocate the proper resources for the implementation and carry through the presented proposition. Before this, no time should be thrown away in wondering what should next happen. Even if everything goes as planned, only the rollout of the first phase of implementation is expected to take until next fall, and before the new system will fully work and the places for additional labeling have been selected and provided with instructions on how to work and the required equipment, we will probably see the year 2009.

As a final point, we would like to stress the importance of coordinated and timely action. With the Feelings product family, the shift to the new operational model relying on mass-customization downstream in the SC should take place at once. Only this way the customers and other relevant stakeholders could be explicitly instructed about the new distribution procedures and the origins of each delivery.

5.9. Limitations of the Proposition

Limitations of the case study approach are mostly related with the lack of generalizability; this thesis includes one case study, but can be only theoretically helpful in other cases where operating circumstances may significantly differ. The holds true if the present circumstances or the competitive environment considerably changes. If, for example, the sales growth in Central and Southeastern Europe discontinues, or the warehouse expansion in Budapest faces unforeseen difficulties that call a halt on the construction work, the whole process and idea of labeling postponement has to be first reconsidered, and then dumped of rescheduled accordingly.

Some of the limitations of this strategy proposition relate to its focus on the distribution channel. The presented framework does not work in delayed product differentiation, which is performed inside the factory only. Moreover, its use practically always leads to a situation where product differentiation (i.e. additional labeling) is postponed to central warehouses/logistics centers, importers or wholesalers. However, this is justifiable because of the current nature of the case company's international distribution.

6. Findings and Conclusions

In this chapter we will evaluate the contribution of this study by summarizing the results and findings. We will focus on the managerial implications because the one and foremost reason of our research was to support the managerial decision making process at Tikkurila Oy, and make it more structured and analytical. Moreover, we will match our findings against the research objectives and conclude what we accomplished and what had to be left for future research.

Modeling the operations of an international paint producer is no jigsaw puzzle where each member has its self-evident place and role in the processes. During the research it became all the more obvious how each party and stakeholder in the process of re-structuring operations has its own perception of things and personal vision of how the company should proceed with its "flexible labeling" idea. Often something that the sales department holds up as an essential part in the design of the product could be first shot down by the layout designer as unfeasible because of the scarcity of space in the product label and then judged to be impractical and impossible to put into effect in real life. And when we take all the international partners into it, and start to think about their individual wishes and capabilities, things really start to get complicated. Each supplier, European subsidiary, national importer, and local wholesaler or bigger retailer tends to have their own thoughts on how, when and by whom certain things should happen, if they even believe in their necessity in the first place. After all the implementation of something like labeling postponement has long reaching effects, and the real challenge is the orchestration of these multi-dimensional customer-based supply chain structures.

6.1. Summary of Research Contribution

The contribution of our research is the combination of several issues rather than only one major finding. We were able to achieve our research objectives and find answers to all of the four initially set research questions. In addition we made various findings related with the concept of labeling postponement. In the next we summarize our findings by as follows: generic supply chain postponement and speculation strategies, factors that favor form postponement, basic structures and dimensions of distribution, and other relevant operating characteristics in designing a supply chain. Each contribution is discussed separately.

6.1.1. Generic supply chain postponement and speculation strategies

Earlier research described four different generic postponement and speculation strategies placed on the postponement-speculations matrix. The contribution of this study is closely built around the ideas characteristic to the manufacturing postponement strategy (see Figure 6-1), and the findings all relate to a situation where final manufacturing operations (in this case labeling) is carried out after the order from the customer and after the products have been to some degree logistically differentiated. As in Figure 6-1, the simplified illustration of Pagh and Cooper (1998), the main idea here is for all the final differentiating steps to take place at a decentralized point close to the market. The same logic is already applied with Tikkurila's paint tinting/colouring system, where the final customization is taken to the retail store level.

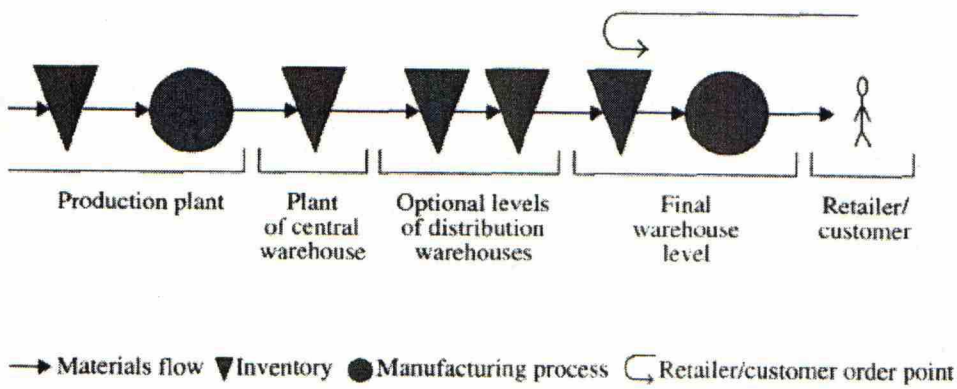


FIGURE 6-1 Illustration of the manufacturing postponement strategy (Pagh & Cooper 1998, p. 17)

The strategy, if employed correctly, leads to a slight increase in manufacturing costs (additional investments, multiple stages of manufacturing, extra workforce), but on the other hand simultaneously helps to cut down the total value of required inventory (reduced number of safety stocks and SKU's). One of the most obvious advantages of postponement that really caught our attention relies on the theory of risk pooling: since the aggregate demand is generally less uncertain, companies can hold smaller inventories while practically providing the same level of service.

6.1.2. Factors that favor form postponement

In Chapter 2 we defined several factors that affect the benefits achievable through form postponement. In the context of our case study, some of them prove worthy of more thorough consideration while some lose their relevance in the case of additional labeling of paint products.

High product value for example is not so relevant in the sense of capital required for inventories, because greater part of product value is still created in the manufacturing phase and only little is added later along the supply chain. On the other hand, postponed labeling helps in cutting down the number of SKU's, and thus helps in keeping the total inventory at a more desirable level. We divided all the factors favoring form postponement into three different categories: product factors, logistical factors and market factors. After discussing the issues related with product and process design, we assessed the fact that as postponement activities are usually most likely placed close to the market, the structure of the SC in each case becomes a central issue.

6.1.3. Basic structures and dimensions of distribution

When implementing labeling postponement, the nature of inventory control changes in the sense of collaboration. Now semi-finished products waiting for customer orders are stocked on multiple echelons. This makes it vital for the factories and regional distribution centers to cooperate seamlessly without any lag in the interchange of information. Transparency of the distribution network becomes decisive in the means of efficiency. The sales executives need to have timely information about the stock-levels of different semi-finished SKU's in each warehousing facility and buffer stock. Only this way the sales people can make reasoned decisions on which stocking point to sell from and how each customer delivery is best executed.

One of our research objectives was to find the appropriate distribution structure for the export of Tikkurila's decorative paints. The basic alternatives and their strengths and weaknesses were first generally described, followed by the detailed analysis of the two most appealing ones. Further, we gave our recommendations for the selection of the appropriate distribution model and listed the most important issues related with development towards the best alternative for Tikkurila's management to give their attention to.

6.1.4. Other relevant characteristics in designing a supply chain

In the literature branding, formulation, and peripherals were listed as product characteristics that help classifying and deciding on the appropriate postponement application. These were then further supplemented with value density and required speed of delivery, which in the case company's situation turned out to be essential when designing a new SC structure. Tikkurila's decorative paint products all have common branding (for the market in question), common formulation, high-to-medium value density, but differ in the peripherals (label texts) that vary in

each market. These characteristics together speak for a deferred labeling system where final manufacturing is positioned in regional warehouses located in Europe. Only by designing the future supply chain to support the use of postponed product labeling, can the company benefit from the concept and this survey in its seek for continuing international growth.

6.2. Theoretical Findings

In recent times the amount of research addressing postponement has greatly increased. Despite the increasing attention to postponement, its applications are still today much less than expected (Van Hoek, 1997; Yang et al., 2004, 2005; Garcia-Dastugue & Lambert, 2007). In 1995, for example, researchers Morehouse and Bowersox predicted that by the year 2010, within the food industry, over 50% of all inventory will be stored in a semi-finished state, and final processing and shipping will only take place against a specific customer order. Still no such figure is achieved soon, and the applications growth has been relatively steady.

The relationship between postponed manufacturing and distribution systems is important, as there is an increasing tendency toward the postponement of all customizing supply chain operations. The pressure to shift operations down the distribution channel has made manufacturing increasingly global with companies rationalizing their operations and having different manufacturing phases located along their supply chains, wherever it is most economical, in each case, to have them. During the research process we concluded that the change of a distribution structure may occasionally be needed for improved performance due either to reduced costs or better customer service (customization) or both. Under specific circumstances the change can both reduce the stock levels (due to less stock-keeping units) and enhance the customer's first perception of the products (thanks to attractive high-quality product labels with end-customers native language), thus improving the total performance of the company.

The integrated framework for labeling postponement discussed in chapter 3, gives a comprehensive overview on the theoretical issues related with postponement and the prerequisites that argue for the viability of labeling postponement (see Figure 3-3). As a central part of our framework we also fitted other concepts (such as centralization, time-based competition, etc.) into labeling postponement and learned how they can support the application of form postponement.

In chapter 5 we discussed the performance factors of labeling postponement, and divided them into investments, cost economies and marketing values. In theoretical literature mostly the cost economies achievable through postponement are discussed. We identified many economies related with transportation, the simplification of inventory planning and management, the decreased number of SKU's, higher service level, and reduced total value of inventory. On the other hand, we discovered that the costs and complexity of the customer order processing most likely increases through postponement.

All in all, with labeling postponement, inventory costs are reduced due to stocking of the paint products carrying only the standardized base label, whereas the total labeling and processing costs are generally slightly higher since operations are no longer truly centralized and labeling is not always done in big batches, thereby losing economies of scale.

What became evident during the research was that the execution of a postponed labeling application also speaks for a forward shift in the evolution of distribution structures (Inkiläinen, 1998), and moving towards regional distribution centers that have value-adding processes (VAL centers). Moreover, one company can globally have numerous such logistical knots, which then can service their appointed regional market areas.

The aspect of internationalization also brought some interesting viewpoint to the discussion about postponed labeling. For an international player in the paint business that is seeing market growth in many individual foreign markets, labeling postponement seems like a logical option, and at the same time presents itself as a step towards a customer-based organization. The stocking of generic products makes it easier to enter new markets with no previous customer accounts because the question dealing with languages printed on the sales package for the most part loses its significance. Generic product assortment also allows the better customization of market-specific product range available for each country.

6.3. Empirical Results and Managerial Implications

The aim of this study was to give, for managerial purposes, some insights, with normative suggestions, into how postponement applications in product labeling are connected with different types of distribution structures, and what kind of possibilities the modern technology combined with postponed manufacturing currently offers. With the case company being on the merge of

change towards more flexible and international supply chain operations, it was relatively easy for an outsider to follow the discussion on the needed change and the internal development of organizational capabilities. Because company managers (almost without exception) find this sort of change processes extremely difficult and risky, our goal was mainly to survey related research and provide support for the managerial process.

In the third chapter we presented our integrated framework for labeling postponement application, which is useful for managers to analyze and define central and less-central issues regarding postponed light manufacturing. The normative framework also helps managers to identify the required steps needed for the successful implementation of postponement and better understand the necessary change in supply chain structure that enables late-customization.

There are practically unlimited different combinations of distinct distribution structures and individual applications of labeling postponement. Because of this, all the feasible alternatives must be evaluated and justified before implementation, as in the event of failure, the way back is certain to be costly. Besides the actual choice, the managers must justify the need and content of the configuration to all stakeholders of the firm. This naturally requires a thorough knowledge of the new system before it can be launched. In acquiring the needed knowledge is where this study can assist managers.

As for other managerial implications, the crucial role of information technology and a suitable database solution emphasized during the research work. It became noticeable that no successful/valuable application of labeling postponement for internationally marketed paint products could be carried out without a fitting IT solution that would in a effective way provide broad international access to the company's shared material. This is why long-term cooperation with some authority with trained IT-consultants and ready-made protocols for different uses is warmly recommended.

In summary, postponement and speculation should be treated as combined concept, and should be implemented in a supply chain context. With the help of this thesis managers are now able to define their existing SC structure quantitatively and compare it with the alternative candidate structures. Increasingly, corporate success will require management to adopt a holistic view of the supply chain and focus on achieving cross-functional integration within the firm and with key members of the supply chain.

6.4. Discussion on the Results

For the postponed labeling to realize and actually work, the locations where the products receive their final touch and are committed to specific customer orders have to be carefully selected. The future distribution network should be reconfigured to support the selected strategy and include new sort of value-adding actors (DCs or other transshipment points). This is why most companies still unfamiliar with postponement react skeptically to the idea of final customization executed by warehouse staff. The application of a new operational model naturally requires innovative thinking, and thus the managers will first need to see the role of labeling postponement as a value-adding concept. That is to say, the management needs to recognize that by differing the packaging and identity (labels) of the products, the members of the distribution channel can create additional value to the end customer, located for example in Greece (a promising but challenging market for Tikkurila).

6.4.1. Tikkurila Corporation lighting the way

As far as postponed manufacturing goes in paint manufacturing business, Tikkurila has established itself a reputation of a pacesetter. The company was among the first manufacturers to break new ground by applying the colouring and tinting techniques later on at the retailing level. This application has now later become an industry standard, and the experience of the company can be seen beneficial when thinking about other postponement related development processes. Thus, the fact that the company has historically been successful in their development practices supports the future success of similar ventures and projects. As a consequence the company profile holds up the expectations of such a development process and further encourages acting upon the results of this study.

6.5. Suggestions for Future Research

Labeling a paint can is a mundane and straightforward activity – one may think. However, the more we studied it the more interesting the problem became. Several challenging areas for further research came across, but here we will focus on those that would extend our analysis and enable better evaluation of the reliability of our results.

During the research project the researcher's attention has focused on two additional issues. Firstly, it is appropriate to propose that in the future the configuration of all manufacturing must

increasingly solve the problematic lingual issues and find some sort of equilibrium between product customization and economies of scale achieved in manufacturing.

Secondly, the role of postponement in supply chain strategy can be studied further to strengthen insights into the link between postponement operating systems and international supply chain strategies. While the two issues certainly have many relations, the research so far has only discussed them superficially.

Thirdly, the management of risk, either in distribution operations or in investments, may become a driving force when designing the new alternative distribution structure. One can logically see the application of late-customization as both a source of risk and an opportunity for an internationally distributing manufacturer.

We still believe that postponement and value adding logistics processes are among the best methods or approaches to meet these challenges. By maintaining and increasing the flexibility of manufacturing and distribution among other logistics operations we are well equipped against uncertainties arising from volatile customer demand and a constantly changing competitive environment.

6.5.1. New research questions

Based on our conceptual analysis and the alternative future scenario breakdown in Chapter 5, this study proposed certain framework to follow when considering postponement of labeling. Also relationships between centralization and postponement and the number of echelons are essential in explaining the structure of a distribution system, and thus present themselves as a potential subject of further examination.

Possible future studies should concentrate on applications of the framework in other industries and other business areas differing in their nature. The author argues that there are many business areas where postponement as a strategy is under-utilized. The advantages of labeling postponement in other business fields can be evaluated by assessing the characteristics of other distinct businesses and further developing modified versions of the framework.

REFERENCES

Bibliography

Abrahamsson Mats (1993) "Time-Based Distribution," *The International Journal of Logistics Management*, Vol.4, No. 2, pp. 75-83.

Alderson W. (1950) "Marketing Efficiency and the Principle of Postponement," *Cost and Profit Outlook 3(3)*, pp. 15-18.

Bask A. H. (2001) "Relationships among TPL providers and members of supply chains – a strategic perspective," *The Journal of Business & Industrial Marketing*, Vol. 16, No.6, pp. 470-486.

Bask A. H. (2006) *Preconditions of Successful Supply Chain Relationships – Integrated Processes and Differentiated Services,* Helsinki School of Economics and Business Administration, A-286, HeSE Print.

Boone C.A., Craighead C.W., & Hanna J.B. (2007) "Postponement: an evolving supply chain concept," *Int. Journal of Phys. Dist. & Logistics Management,* Vol. 37, No. 8, pp. 594-611.

Bowersox Donald .J., Closs David J. & Cooper M. Bixby (2007) *Supply Chain Logistics Management, Second Edition – International Edition,* McGraw-Hill Education.

Bucklin, L.P. (1965) "Postponement, speculation, and the structure of distribution channels", *Journal of Marketing Research (February)*, pp. 26-32.

Cooper Martha C., Lambert Douglas M., Pagh Janus D. (1997) "Supply Chain Management: More Than a New Name for Logistics," *The International Journal of Logistics Management*, Vol.8, No. 1, pp. 1-14.

Cravens David W. (1994) *Strategic Marketing,* 4th edition, Richard. D Irwin, Inc, USA.

Ellram L. M. (1996) "The use of the case study method in logistics research," *Journal of Business Logistics*, Vol. 17, No. 2, pp. 93-138.

Garcia-Dastugue, Sebastian J. and Lambert Douglas M. (2007) "Interorganizational Time-based Postponement in the Supply Chain," *Journal of Business Logistics*, Vol. 28, No.1, pp. 57-81.

Gardner John T. & Cooper Martha C. (2003) "Strategic Supply Chain Mapping Approaches," *Journal of Business Logistics*, Vol. 24, No. 2, pp. 37-63.

Harrison A. & Van Hoek R. (2005) *Logistics Management and Strategy – 2nd Edition,* Pearson Education Limited, England.

Helander Anton (1999) "Impact of Form Postponement on Channel Members' Performance in Paint Business: A Theoretical Approach," *Liiketaloudellinen aikakauskirja* 3/99, pp. 225-237.

Inkiläinen Aimo (1998) *Managerial Views on Distribution Systems – Heuristic Justification of Centralization and Postponement,* Helsinki School of Economics and Business Administration, A-140, HeSE Print.

Krajewski Lee J. & Ritzman Larry P. (2001) *Operations Management: strategy and analysis, 6th edition*, Prentice Hall, USA.

Lambert Douglas M., Cooper Martha C. and Pagh Janus D. (1998) "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management,* Vol.9, No.2, pp. 1-19.

Lambert Douglas M., Garcia-Dastugue S. J. and Croxton K. L. (2005) "An Evaluation of Process-Oriented Supply Chain Management Frameworks," *Journal of Business Logistics*, Vol. 26, No.1, pp. 25-51.

Langley John C. and Holcomb Mary C. (1992) Creating Logistics Customer Value, *Journal of Business Logistics*, Volume 13, No.2, pp.1-28.

Lee, Hau L & Tang, Christopher S. (1997) Modelling the Costs and Benefits of Delayed Product Differentiation, *Management Science,* Vol. 43, No. 1, pp. 40-53.

Maister, D.H. (1976) "Centralization of Inventories and the 'Square Root Law'", *International Journal of Physical Distribution and Logistics Management*, Vol. 6, No. 3, pp. 124-134.

Pagh J.D. & Cooper M.C. (1998) "Supply chain postponement and speculation strategies: how to choose the right strategy," *Journal of Business Logistics*, Vol. 19, No. 2, pp. 13-33.

Sachan A. & Datta S. (2005) "Review of Supply Chain Management and Logistics Research", *International Journal of Physical Distribution & Logistics Management,* Vol. 35, No. 9, pp. 664-705

Swaminathan J.M.& Lee Hau L. (2003) Handbooks in OR & MS, Vol. 11, Elsevier B.V.

Tallon William J. (1993) "The Impact of Inventory Centralization on Aggregate Safety Stock: The Variable Supply Lead Time Case", *Journal of Business Logistics*, Vol. 14, No. 1, pp. 185-203.

Twede, D, Clarke R.H, Tait J. (2000): Packaging Postponement: A Global Packaging Strategy, *Packaging Technology and Science,* 13, pp. 105-115.

Van Hoek, Remko I. (1997) "Postponed manufacturing: a case study in the food supply chain," *Supply Chain Management*, Vol. 2, No. 2, pp. 63-75.

Van Hoek, Remko I. (1998) Postponed manufacturing in European supply chains – A triangular approach, Netherlands Geographical Studies, Utrecht 1998.

Van Hoek, Remko I. (2001) The rediscovery of postponement a literature review and directions for research, *Journal of Operations Management,* No.19, pp. 161-184.

Warren Don (2003) Roller coaster ride continues for paint labeling, *Coatings*, Oakville: May/Jun 2003, Vol. 24, Issue 6, pg. 78.

Yang B., Burns N.D. and Blackhouse, C.J (2004) Postponement: A review and an integrated framework, *International Journal of Operations & Production Management,* vol.24, no.5, pp. 468-487.

Yang, B, Burns, Neil D. and Blackhouse, C.J. (2005) The Application of Postponement in Industry, *IEEE Transaction on Engineering Management,* vol.52, no.2, pp. 238-248.

Zinn W., Bowersox D.J. (1988) "Planning physical distribution with the principle of postponement", *Journal of Business Logistics 9*, pp. 117-137.

Zinn W. (1990) "Developing heuristics to estimate the impact of postponement on safety stock," *The International Journal of Logistics Management*, 1, 2, pp. 11-16.

Other Sources

Tikkurila Group's Internet pages, Investor Information:
http://www.tikkurila.com (multiple dates)

United Nations Economic Commission for Europe, Transport Division,
Globally Harmonized System of Classification and Labeling of Chemicals (GHS):
http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html (9.11.2007)

Maximum freight weights in road transportation (Europe):
http://www.dhl.fi/publish/fi/fi/information/shipping/Transport_Equipment/Transport_Equipment_Road_Freight.high.html (10.3.2008)

Interviews

Hamberg Johanna, Head of Document MGT and Labeling, Orion Corporation, Espoo, 4.4.2008.

Hokkila Antti, Transportation Management, Tikkurila Oy, Vantaa, 15.2.2008.

Ihamäki-Laitinen Minna, Business Support, Tikkurila Coatings Oy, Vantaa, 27.11.2007.

Järvinen Petri, Director, Business Support, Tikkurila Coatings Oy, Vantaa, 27.11.2007.

Käkelä Mila, Sales Executive, Deco International, Tikkurila Oy, Vantaa, 21.2.2008.

Romanovska Ineta, Marketing Manager for Deco International, Vivacolor Ltd, Tikkurila Group, Vantaa, 10.10.2007.

Saarenpää Jari, Head of DSN Management, Nokia Corporation, Tampere, 21.1.2008.

Supervisors of the Project, September 2007 – April 2008

Bask Anu	Professor	HSE
Inkiläinen Aimo	Doctor	HSE

Members Contributing to the Case Study, September 2007 – April 2008

Aaltonen Paula, Manager, Demand & Supply Planning, Global Sourcing and Supply Chain Management, Tikkurila Oy, Vantaa.

Cederström Eija, Sales Executive, Tikkurila Oy, Vantaa.

Hokkila Antti, Transportation Manager, Tikkurila Oy, Vantaa.

Kesä Markus, Tikkurila Oy, Vantaa.

Laamanen Raimo, Vice President, Logistic Supply Chain, Alcro-Beckers / Tikkurila Oy, Vantaa

Mölsä Mika, Transportation, Tikkurila Oy, Vantaa.

Pulli Sisko, Purchasing Manager, Tikkurila Oy, Vantaa.

Pykäläinen Mikko, Sales Executive, Tikkurila Oy, Vantaa.

Saljola Alia, Store Marketing, Tikkurila Oy, Vantaa.

Salmela-Ibrahim Eila, Tikkurila Oy, Vantaa.

Salonen Pasi, Tikkurila Oy, Vantaa.

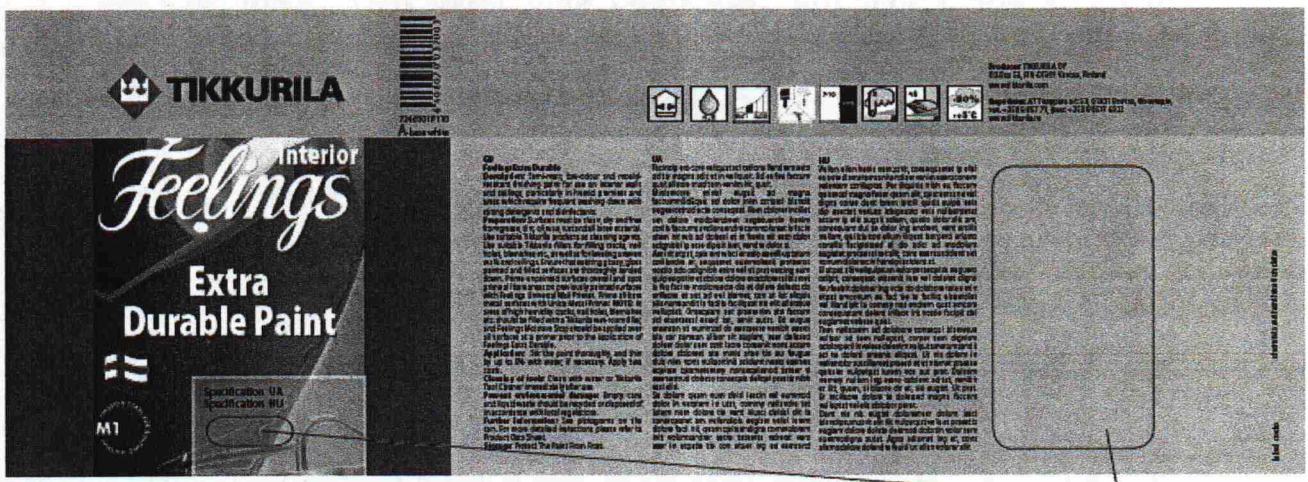
Savioja Sari, Tikkurila Oy, Vantaa.

Söderholm Thomas, Sales Manager, Tikkurila Oy, Vantaa.

Appendix 1: Exemplary labels for Tikkurila's Feelings product family

Below are illustrated the differences between a color printed base label and a finished product label reaching the customers. The varying components of the product label are encircled and represent the flexibility created through the new layout of the label:

BASE LABEL

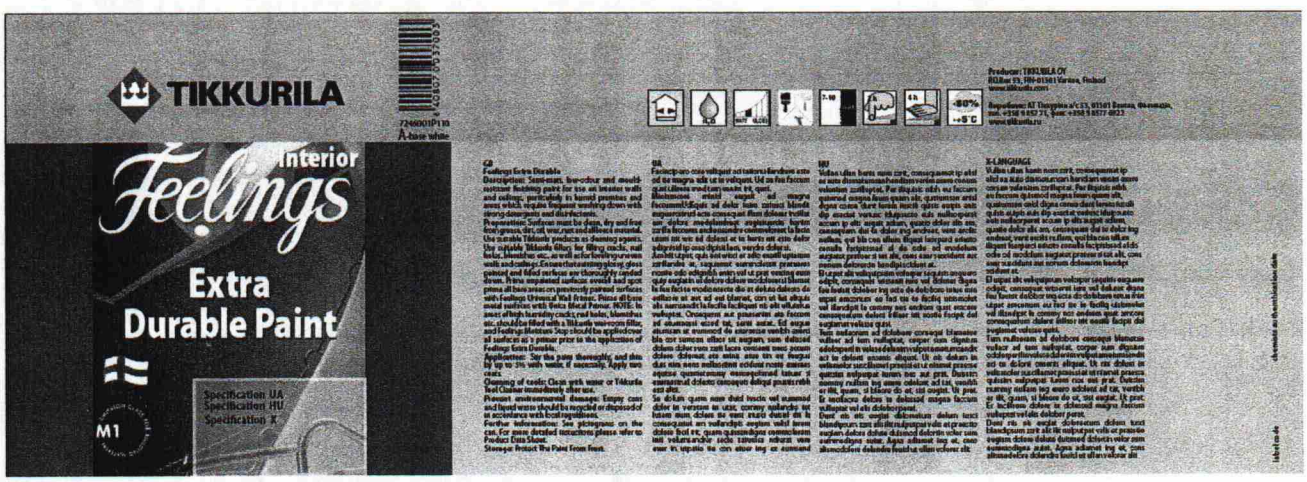


When the paint can is filled the filling line uses this base label with 3 major languages ready-printed on the label. After filling the products are stored on the warehouse shelves without group package and schrink wrap, supposing that it is possible with current logistic system and pallet robots. The can is stored and waiting for sales and delivery.

Empty fields are reserved for necessary extra language stickers after the product is sold to certain market area.

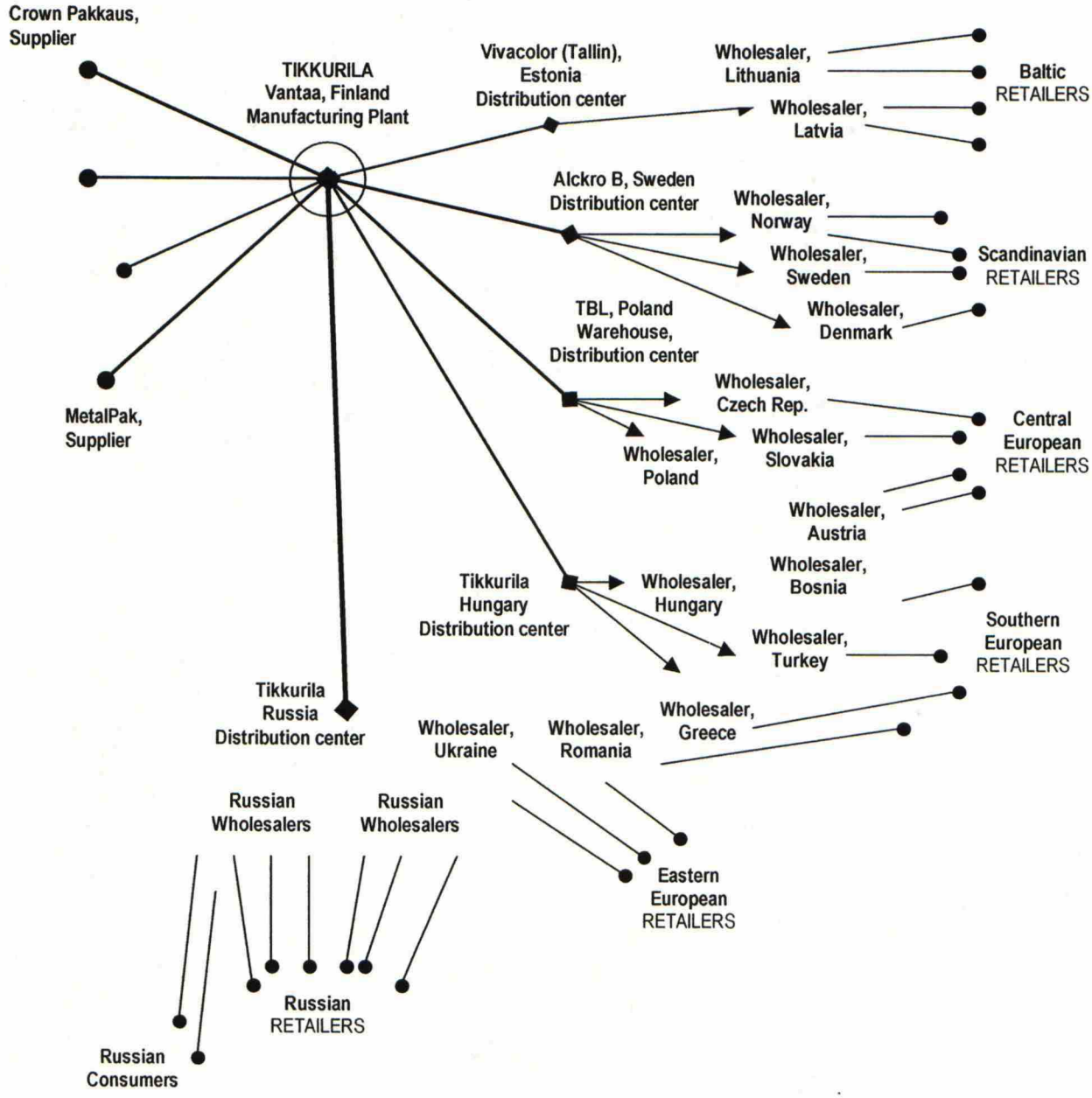
Note that just one sales item is needed per one product/one package size.

FINISHED LABEL (MASS-CUSTOMIZED PRODUCT)



The product labels depicted above are label designs of Feelings product family, on which the group has decided to pilot the implementation of so called "flexible labeling". Extra Paint is one of the core products in the product family and was last year sold in all the seven countries included in the piloting phase.

Appendix 2: The "network" nature of Tikkurila Paint's distribution network



Appendix 3: The annual transportation costs with direct customer deliveries

ANNUAL ROAD HAULAGE COSTS WITH DIRECT DELIVERIES — **Calculations based on simulated sales figures for the year 2008**

Tikkurila Oy - Deco International — TIKKURILA

European Product Range & Feelings Product Family

1 paint pallet = approx. 550 kgs

can size in litres	1/3	1	3	10
cans per pallet from Vantaa	910	420	120	44
kg/litre multiplier	1,265	1,35	1,35	1,335

FEELINGS (annual sales in litres)

Ukraine

Master Product Name	1/3	1	3	10	total	1/3	1	3	10	total in kg's
Universal Primer	-	-	866	170	1036	-	-	1169,1	226,95	1396,05
Wall Paint	1920	8940	10450	2860	24170	2428,8	12069	14107,5	3818,1	32423,4
Extra	-	5980	7558	3420	16958	-	8073	10203,3	4565,7	22842
Extra Primer	-	-	1966	-	1966	-	-	2654,1	-	2654,1
Effect Paint	-	2788	-	-	2788	-	3763,8	-	-	3763,8
Ceiling Paint	-	-	4266	2110	6376	-	-	5759,1	2816,85	8575,95
Wood Finish	-	2198	2789	-	4987	-	2967,3	3765,15	-	6732,45
Wood Primer	-	833	733	-	1566	-	1124,55	989,55	-	2114,1
					59847 litres/year					80501,85 kg's of shipments
										80,50185 tons

Feelings sales started in August. No comparative figure.
Sales from 8/2007 to 12/2207 = 33356 litres
Expected growth for sales = around 80% which equals to about 60 000 litres

FEELINGS (annual sales in litres)

Hungary

Master Product Name	1/3	1	3	10	total	1/3	1	3	10	total in kg's
Universal Primer	-	-	789	820	1609	-	-	1065,15	1094,7	2159,85
Wall Paint	1590	14923	13213	8990	38716	2011,35	20146,05	17837,55	12001,65	51996,6
Extra	-	2531	3233	2130	7894	-	3416,85	4364,55	2843,55	10624,95
Extra Primer	-	-	333	-	333	-	-	449,55	-	449,55
Effect Paint	-	1860	-	-	1860	-	2511	-	-	2511
Ceiling Paint	-	-	0	0	0	-	-	0	0	0
Wood Finish	-	321	466	-	787	-	433,35	629,1	-	1062,45
Wood Primer	-	166	113	-	279	-	224,1	152,55	-	376,65
					51478 litres/year					69181,05 kg's of shipments
										69,18105 tons

Total actual sales for year 2007 for Feelings products (in litres)

1377	34871,4	6338,4	0	1521	0	553,5	45
							44706 litres/year = 166 068 €
				Expected sales growth for the year 2008=		15 %	115 % 3,715 € euros/sold litre
							51412 litres/year

FEELINGS (annual sales in litres)

Greece

Master Product Name	1/3	1	3	10	total	1/3	1	3	10	total in kg's
Universal Primer	-	-	3090	2330	5420	-	-	4171,5	3110,55	7282,05
Wall Paint	55	112	213	30	410	69,575	151,2	287,55	40,05	548,375
Extra	-	1115	1433	860	3408	-	1505,25	1934,55	1148,1	4587,9
Extra Primer	-	-	0	-	0	-	-	0	-	0
Effect Paint	-	0	-	-	0	-	0	-	-	0
Ceiling Paint	-	-	0	0	0	-	-	0	0	0
Wood Finish	-	2222	2133	-	4355	-	2999,7	2879,55	-	5879,25
Wood Primer	-	689	799	-	1488	-	930,15	1078,65	-	2008,8
					15081 litres/year					20306,375 kg's of shipments
										20,306375 tons

Total actual sales for year 2007 for Feelings products (in litres)

5008,5	8,1	3114	0	0	0	4361,4	1164
							13656 litres/year
				Expected sales growth for the year 2008=		10 %	1,1
							15022 litres/year

FEELINGS (annual sales in litres)

Romania

Master Product Name	1/3	1	3	10	total	1/3	1	3	10	total in kg's
Universal Primer	-	-	589	480	1069	-	-	795,15	640,8	1435,95
Wall Paint	1482	14600	12533	9200	37815	1874,73	19710	16919,55	12282	50786,28
Extra	-	2651	3899	1820	8370	-	3578,85	5263,65	2429,7	11272,2
Extra Primer	-	-	33	-	33	-	-	44,55	-	44,55
Effect Paint	-	1468	-	-	1468	-	1981,8	-	-	1981,8
Ceiling Paint	-	-	0	0	0	-	-	0	0	0
Wood Finish	-	420	353	-	773	-	567	476,55	-	1043,55
Wood Primer	-	288	189	-	477	-	388,8	255,15	-	643,95
					50005 litres/year					67208,28 kg's of shipments
										67,20828 tons

Total actual sales for year 2007 for Feelings products (in litres)

243	116	715	0	45	0	68	0
							1187 litres/year
				Expected sales growth for the year 2008 if Romania activates= 200 000 €			50 000 litres/year

FEELINGS (annual sales in litres)

Slovakia

Master Product Name	1/3	1	3	10	total	1/3	1	3	10	total in kg's
Universal Primer	-	-	0	0	0	-	-	0	0	0
Wall Paint	870	1909	1946	820	5545	1100,55	2577,15	2627,1	1094,7	7399,5
Extra	-	444	606	490	1540	-	599,4	818,1	654,15	2071,65
Extra Primer	-	-	0	-	0	-	-	0	-	0
Effect Paint	-	679	-	-	679	-	916,65	-	-	916,65
Ceiling Paint	-	-	0	0	0	-	-	0	0	0
Wood Finish	-	189	39	-	228	-	255,15	52,65	-	307,8
Wood Primer	-	157	136	-	293	-	211,95	183,6	-	395,55
					8285 litres/year					11091,15 kg's of shipments
										11,09115 tons

Total actual sales for year 2007 for Feelings products (in litres)

0	5722	98	0	216	0	122	200
							6358 litres/year
				Expected sales growth for the year 2008=		30 %	1,3
							8265 litres/year

FEELINGS (annual sales in litres)

Poland can size in litres:

Master Product Name	1/3	1	3	10	total
Universal Primer	-	-	133	120	253
Wall Paint	980	4560	6890	1670	14100
Extra	-	3478	3679	880	8037
Extra Primer	-	-	0	-	0
Effect Paint	-	8830	-	-	8830
Ceiling Paint	-	-	776	220	996
Wood Finish	-	158	133	-	291
Wood Primer	-	39	24	-	63
					32570 litres/year

total in kg's
339,75
18926,65
10836,75
0
11920,5
1341,3
392,85
85,05
43842,85 kg's of shipments
43,84285 tons

Total actual sales for year 2007 for Feelings products (in litres)

187	13059	7955	0	8838	810	227	50
							31126 litres/year
				Expected sales growth for the year 2008=		5 %	1,05
							32682 litres/year

FEELINGS (annual sales in litres)

Czech Republic can size in litres:

Master Product Name	1/3	1	3	10	total
Universal Primer	-	-	243	80	323
Wall Paint	230	324	466	220	1240
Extra	-	86	96	0	182
Extra Primer	-	-	0	-	0
Effect Paint	-	590	-	-	590
Ceiling Paint	-	-	0	0	0
Wood Finish	-	241	196	-	437
Wood Primer	-	122	99	-	221
					2993 litres/year

total in kg's
434,85
1651,15
245,7
0
796,5
0
589,95
298,35
4016,5 kg's of shipments
4,0165 tons

Total actual sales for year 2007 for Feelings products (in litres)

252	935	13	0	302	0	419	212
							2133 litres/year
				Expected sales growth for the year 2008=		40 %	1,4
							2986 litres/year

Vantaa - Kiev transportation costs 2945,8 €/FTL 19t weight limit
Average transportation costs per ton **155,04** euros/ton
Costs per master product

Universal Primer	216,4 €
Wall Paint	5 027,0 €
Extra	3 541,5 €
Extra Primer	411,5 €
Effect Paint	583,5 €
Ceiling Paint	1 329,6 €
Wood Finish	1 043,8 €
Wood Primer	327,8 €
	12 481,2 € euros/year

Vantaa - Martin, SK transportation costs 1927 €/FTL
Average transportation costs per ton **96,35** euros/ton
Costs per master product 20t weight l

Universal Primer	0,0 €
Wall Paint	712,9 €
Extra	199,6 €
Extra Primer	0,0 €
Effect Paint	88,3 €
Ceiling Paint	0,0 €
Wood Finish	29,7 €
Wood Primer	38,1 €
	1 068,6 € euros/year

Vantaa - Budapest transportation costs 2405 €/FTL double decker
Average transportation costs per ton **109,32** euros/ton
Costs per master product 22t weight limit

Universal Primer	236,1 €
Wall Paint	5 684,2 €
Extra	1 161,5 €
Extra Primer	49,1 €
Effect Paint	274,5 €
Ceiling Paint	0,0 €
Wood Finish	116,1 €
Wood Primer	41,2 €
	7 662,7 € euros/year

Vantaa - Lodz, PL transportation costs 2108 €/FTL double decker
Average transportation costs per ton **95,81818182** euros/ton
Costs per master product 22t weight l

Universal Primer	32,6 €
Wall Paint	1 813,5 €
Extra	1 038,4 €
Extra Primer	0,0 €
Effect Paint	1 142,2 €
Ceiling Paint	128,5 €
Wood Finish	37,6 €
Wood Primer	8,1 €
	4 200,9 € euros/year

Vantaa - Inofita transportation costs 5885 €/FTL double decker
Average transportation costs per ton **294,25** euros/ton
Costs per master product 20t weight limit

Universal Primer	2 142,7 €
Wall Paint	161,4 €
Extra	1 350,0 €
Extra Primer	0,0 €
Effect Paint	0,0 €
Ceiling Paint	0,0 €
Wood Finish	1 730,0 €
Wood Primer	591,1 €
	5 975,2 € euros/year

Vantaa - Kralupy N.Vi, CZ transportation cos 2393 €/FTL double decker
Average transportation costs per ton **108,77** euros/ton
Costs per master product 22t weight l

Universal Primer	47,3 €
Wall Paint	179,6 €
Extra	26,7 €
Extra Primer	0,0 €
Effect Paint	86,6 €
Ceiling Paint	0,0 €
Wood Finish	64,2 €
Wood Primer	32,5 €
	436,9 € euros/year

Total annual road transportation costs with direct market deliveries with nominated LSP's = **43 890 €**

Vantaa - Bukarest transportation costs 3620 €/FTL double decker
Average transportation costs per ton **181** euros/ton
Costs per master product 20t weight limit

Universal Primer	259,9 €
Wall Paint	9 192,3 €
Extra	2 040,3 €
Extra Primer	8,1 €
Effect Paint	358,7 €
Ceiling Paint	0,0 €
Wood Finish	188,9 €
Wood Primer	116,6 €
	12 164,7 € euros/year

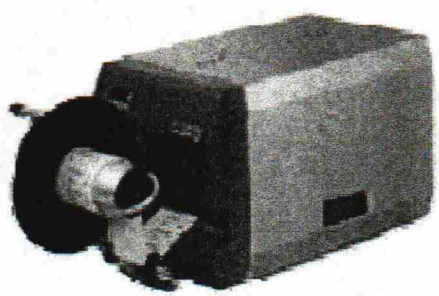
Appendix 4: Exemplary printing equipment enabling the application of labeling postponement

Below are illustrated a couple of sticker printers suitable for the use of smaller middlemen in the distribution channel of any international manufacturer applying labeling postponement. Both of the models are represented in Finland by Informa Oy. On the markets are many similar reasonably sized effective printers available with the capability of printing on blank or transparent sticker-reels:

Avery Dennison 64 label printer

Model	**6404 Basic, Gen. 3**
Technology	Thermal printer head, NearEdge 300dpi
Width of the print	106,6 mm
Resolution	300dpi
Printing speed	50-400 mm/s
Diameter of the label reel	max. 210 mm
Connections	Centronix RS-232 Ethernet USB

Optionally unit, with 3" casing	**6404, Gen. 3 + Fixed reeling**
Installation	**Installation and instructions for use in Tikkurila, Vantaa as agreed.**
Delivery time	**around 3 weeks from the order**



Source: Informa Oy, Espoo - Finland

informa